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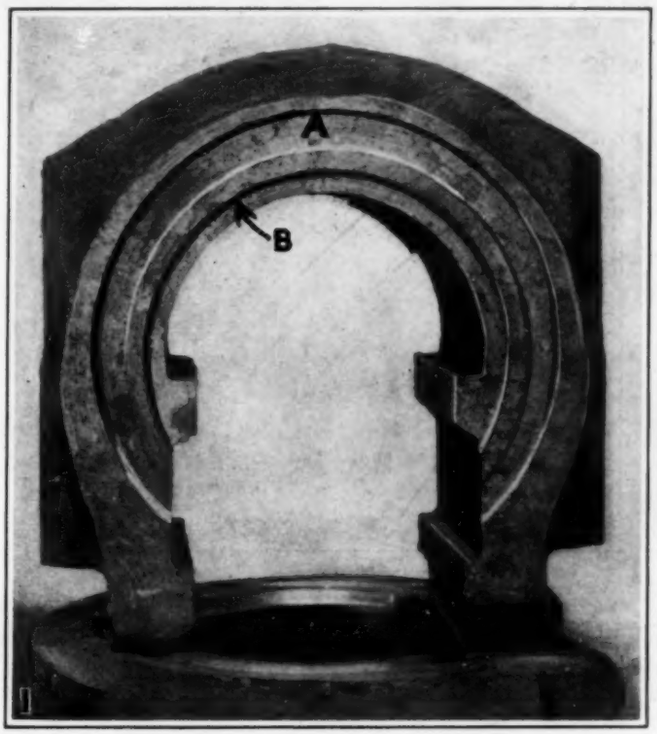


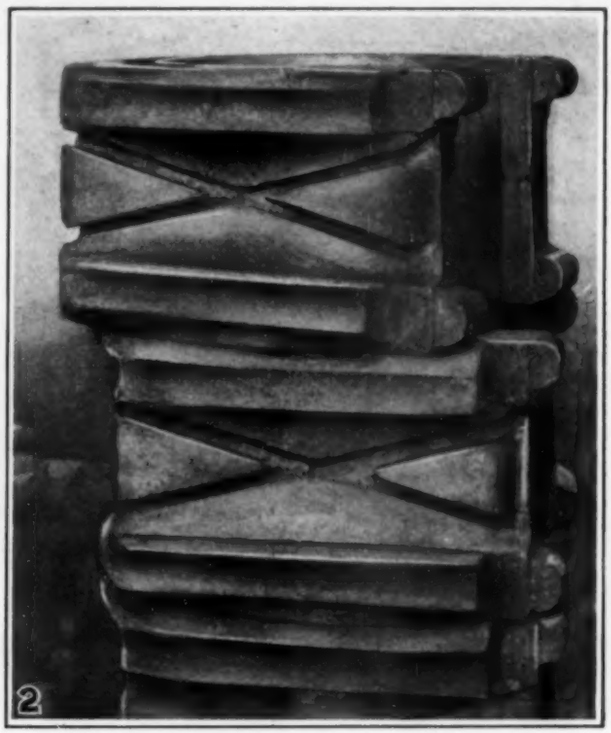


Fig. 1—Driving box ready for casting crown brass and hub liner. *Fig. 2—Grooves for anchoring bearing metal*

Driving-Box Practice

On the Western Maryland

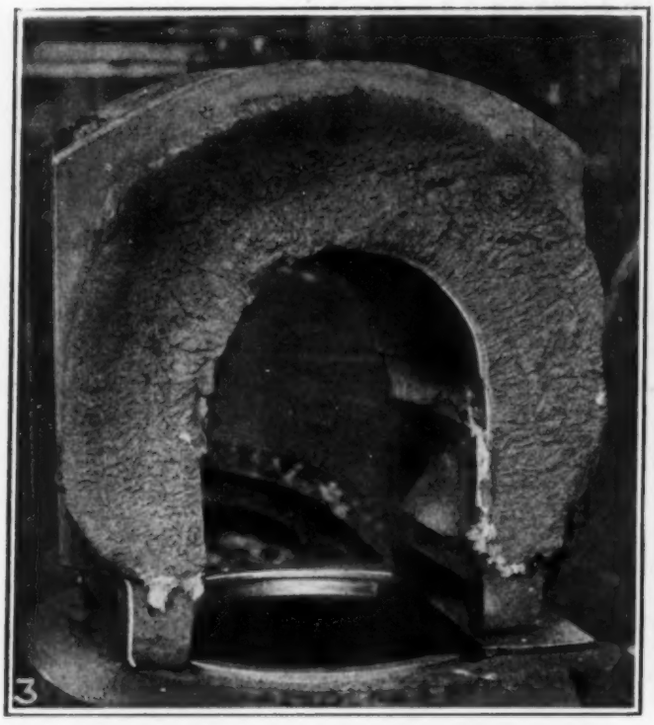
By S. Ashton Hand
Associate Editor, *American Machinist*

Crown brasses and hub liners cast in place—
Bronze surfaces for the shoe and wedge fits—
Tool for cutting oil grooves—Truing crankpins

WHILE the practice of casting crown brasses and hub liners in place and in one piece is not new, the Western Maryland Railway has inaugurated some methods at its Hagerstown shops, that have been the means of saving considerable machine work on the driving boxes proper.

In the case of entirely new boxes, no machining whatever is done on the interior, thus eliminating the usual slotting operation for the seats of the crown brasses. The boxes are, of course, faced on both sides as usual, and the faces next to the driving wheels have dovetailed grooves turned in them as shown in Fig. 1 at *A*. The grooves are not concentric with the bores of the crown brasses nor are their edges equidistant, but further apart at the top than at the bottom. By their eccentric position and variation of width at all points the grooves provide a lock that resists any tendency of the hub liners to be turned by the friction of the driving-wheel hubs, and to break away from the outer ends of the crown brasses. As an additional safeguard, the boxes are recessed as at *B*, providing for heavier metal where the crown brasses and hub liners join.

Before having the crown brasses and hub liners cast, the boxes are preheated in a special furnace, being brought to a low-red heat—a heat that approximates that of the melting point of brass. No attempt has been made to control the temperature of the furnace by the use of a pyrometer, the boxes being withdrawn from the furnace when heated to the proper degree as judged by the eye. By preheating, both the metal in the boxes



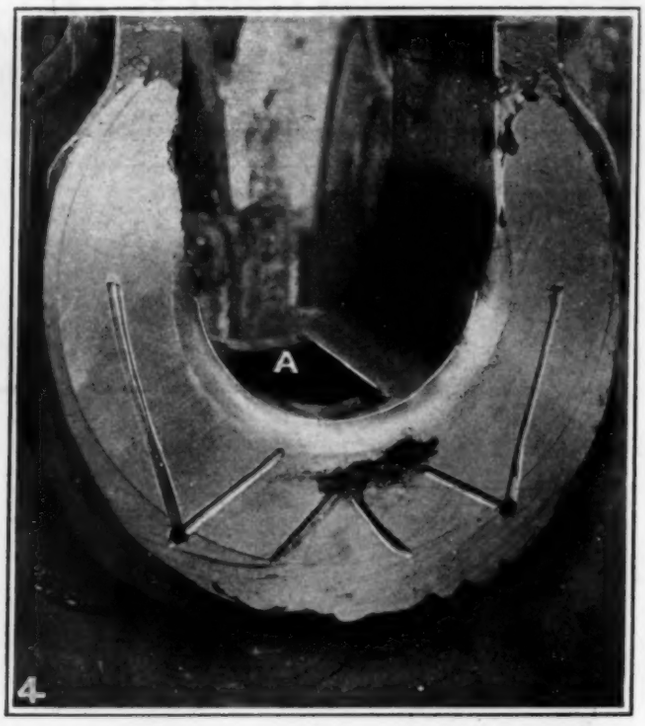


Fig. 3—After the crown brass and hub liner have been cast. *Fig. 4—After the bearings have been machined*

and that of the bearing metal cast in them will shrink practically the same on cooling, and thus prevent looseness due to unequal shrinkage.

After the crown brasses and hub liners have been cast, the boxes are placed in a fixture and brass is cast on the sides that bear against the shoes and wedges. Provision for anchoring the bearing metal at these points is made, as shown in Fig. 2, by coring two dovetail grooves in the shape of an elongated letter X in both sides of the boxes at the time they are cast. In the case of boxes made before the practice of coring the dovetail grooves in the sides was adopted, the grooves are planed in. A box after the crown brass and hub liner have been cast in place, is shown in Fig. 3, and in Fig. 4 after these parts have been machined. It should be noted, in Fig. 4, that the center of the crown brass has been cored out at *A* to form a chamber for grease.

While it would appear contrary to good practice to reduce the area of that part of a bearing sustaining the greatest weight, it has been found that the wear on crown brasses with a full bearing in the center is

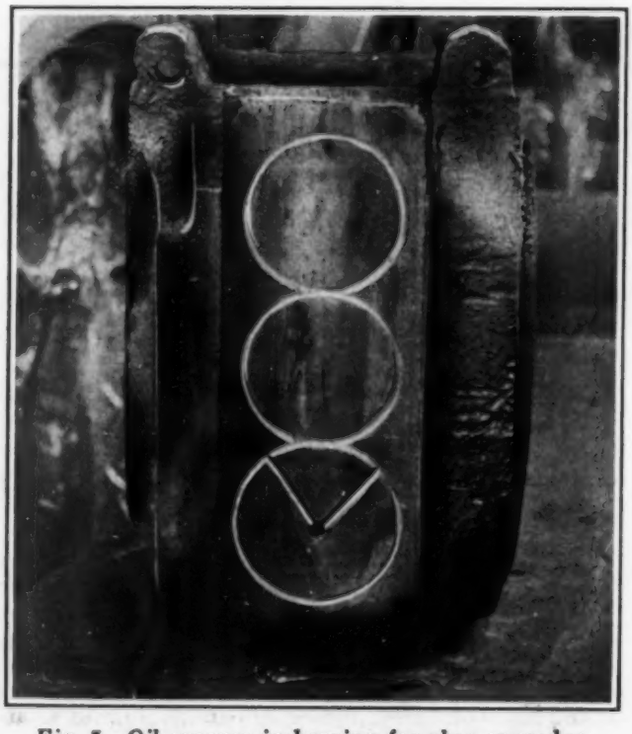


Fig. 5—Oil grooves in bearing for shoe or wedge

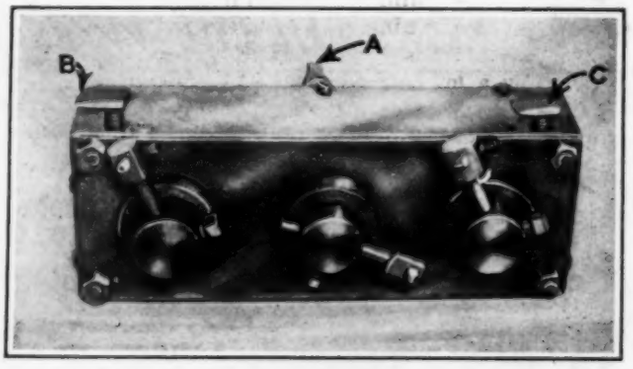


Fig. 6—Tool for cutting oil grooves

greater at the sides than in the center, due to the push and pull of the pistons. In order to equalize the wear and thus reduce the number of renewals, experiments have been carried out at the Hagerstown shops to determine the amount of reduction of area necessary to accomplish the desired result. Incidentally, in reducing the area of the bearing surface, advantage has been taken of the opportunity to provide for lubrication at a much needed point.

In Fig. 5 may be seen one edge of a driving box after the brass for the shoe and wedge bearing has been cast and machined. The oil grooves formed by the

three circles are cut by the tool shown in Fig. 6. The tool is used in the drill press and the two end cutters are driven by the spindle of the one in the center, through gears enclosed in the hollow body. The end of the shank of the center cutter spindle is just visible at *A*. The two outer cutters, of course, revolve in the opposite direction to that of the one in the center, making it necessary to use both right- and left-hand cutters. The flat-headed screws at *B* and *C* have counterparts on the opposite side of the body, and are used

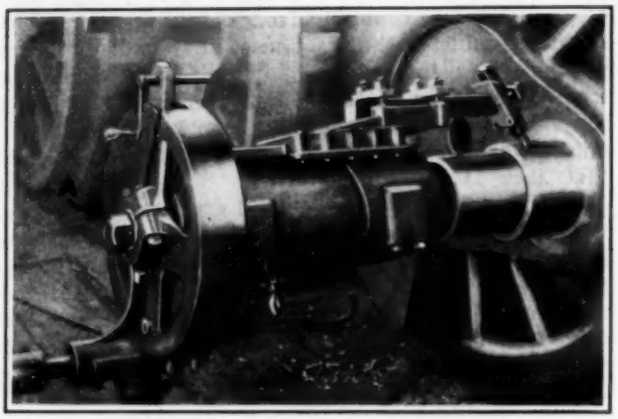


Fig. 7—Re-turning a crankpin in place

both to center the tool between the flanges of the box and to hold it from moving while the grooves are being cut. This same tool is used for cutting oil grooves in the bearing surfaces of crossheads where they slide upon the guide bars. The operation is a very simple one and requires but a few minutes.

While the re-turning of crankpins has nothing to do with driving boxes, *per se*, it is an essential part of locomotive repairs, and is an operation that can be seen but seldom unless one happens to be on the spot at the psychological moment.

Re-turning or truing a crankpin in place is illustrated in Fig. 7. The turning device is centered upon the pin by the use of a bushing of the proper size and is held in place by a long drawbolt, the nut of which can be seen at *A*. In the case of crankpins having threaded ends, threaded bushings are used and the drawbolt omitted. The outboard end of the device is supported by a jack. The drive is by an air motor, the spindle of which is attached to the driving shaft of the device by a sleeve coupling. The feed is obtained by the usual star wheel.

Radiators and Radiation

Now that the cold days are coming along it is time to think about putting the heating plant in shape. Here is a little tip that will help a lot to keep the shops warm at no cost to anyone.

A radiator or steam coil, to function effectively, must have clear space around it for the circulation of air and to give it a chance to radiate to advantage.

Every time a sheet of steel is laid against one or miscellaneous junk is stuck behind, just to get it out of the way, a lot of its ability to put heat in the room is robbed. No amount of steam in the pipes will do any good until the blanketing obstructions are removed. Just try, during this winter, to keep things clear of the heating system and be warm as a result.

How France Gets Planes at Low Cost

AIRCRAFT builders in America will be interested in some of the statements of M. Henri Bouche, editor of *L'Aeronautique*, who has been studying the development of aviation in this country.

"French air appropriations this year total about 500,000,000 francs, equivalent at prevailing exchange to $22,000,000, though, when the purchasing power of the franc is considered, the amount is larger.

"While we have aviation in Army, Navy, Colonial and Undersecretariat, our purchases for all equipment are made through the French Supply Service. By having a common purchasing organization we get the most out of our money. With annual appropriations about equal to yours in purchasing power, we have been able to buy each year 1,000 to 1,200 planes and 1,200 to 1,500 engines.

"The French government does not manufacture airplanes, engines, propellers, instruments, parts, accessories or supplies. We have no government aircraft factory. All money for construction thus goes to the industry. We do not attempt to tell the manufacturers how to build in detail, and we thereby encourage industrial initiative. Our policy is one of deliberate encouragement. We seek competition in design. When our technical service calls for new designs, they are submitted to a commission, representing army, navy and civil aviation. Experimental orders are given at a negotiated price to a successful designer. Should the type go into production, specified number of airplanes is first ordered from the designer, and the rest are then allocated, at a negotiated price, to other units of the industry. Design rights are recognized by the government and industry and royalties are paid to the designer.

"The French government buys specimens of foreign aircraft for experimental purposes, but is not inclined to permit a foreigner to come in, set himself up in business on a government order, and then compete with our own industry. That would be contrary to public policy and would be unwise from the standpoint of national defense. Foreigners must deal through accredited French plants. The French aircraft industry consists of about 20 aircraft and six engine plants. All told, these employ about 10,000 men."

It is particularly interesting to note the number of planes and engines France secures, with about the same appropriation as we spend for a comparatively few planes.

One reason why France gets airplanes at low cost, is given in the significant statement that "we do not attempt to tell manufacturers how to build in detail." In contrast to this, American plants are badly handicapped. One plant building planes for army, navy and marine corps, had three sets of inspectors interfering with the work and all demanding different changes in the planes being built for their service. The industry cannot thrive under such conditions and we are not getting as good planes as though the engineers who designed them were given a free hand.

And this condition applies to much besides airplanes. All planes and aviation material should be bought through one central agency. And this single division should also operate all planes, assigning them to whatever branch of the service that can use them.

The Art of Resigning

By J. Nuerman

MOST of us, sometime or other in our lives, have resigned from positions or from the more ordinary "job." Some of us have done so voluntarily. Others have been compelled to do so by force of circumstances —usually the boss. How often do we read the personal item in what has sometimes been called the agony column. "Jack Jones has resigned from the Robinson Co. His future plans are not yet stated." How rarely do we visualize what lies behind this simple statement.

Here is friend Jack Jones working along steadily, perhaps, as well as he knows how but for many reasons he is out of sympathy with the boss. He and the boss don't "hit off" together particularly well. The boss likes things done one way and Jack just naturally can't see it that way, and wants to follow the practice he learned in Smith's shop some years ago. So Jack goes home to his wife and tells her his troubles, and she, good wife, sympathizes with him and backs him up, and between them there is a lot of self pity, until it dawns on them that they need not stand the situation at all. In fact they begin to feel that Jack has only to threaten resignation and the boss will fall all over himself to make things right. Perhaps even in their optimism they will see visions of an increased salary.

Meanwhile what is the boss thinking? Well he doesn't like checking up on Jack all the time any more than Jack does, and he wonders why in H— Jack can't do the work the way he is told. He realizes that his is the responsibility and that it is up to him to get the work out right and on time. He begins to get sore at Jack, and eventually thinks of firing him. One day matters come to a show down between the two, and Jack gets in first word and resigns to the delight of the boss.

Jack is through. He packs up his tools, hies home to the wife and that evening there is joy in the house coupled with a few regrets that he didn't tell the boss a little more where he "got off at." But next day there is a new job to seek, and possibly the day after, and Jack may drop $50 in time, or even more, hunting up a new job. Now the $50 loss is the same as one dollar a day reduction in weekly pay for the next year, but Jack doesn't always size it up that way. Further, when he does find a new boss he also finds that the new one is as full of peculiarities as the old one, but they are of a different kind. Or, if it is not the boss, then it is someone else. In fact he is not so much better off after all. Jack should not have resigned in the first place.

Resigning Does Not Help

No sir! He should have stayed right on. Resigning was the simplest, most foolish thing he could have done for the reasons—or lack of reasons—that he had. He resigned simply because he lacked a knowledge of the principles of employment. He should have realized that it was not entirely up to the boss to sell himself to Jack, but very much up to Jack to sell himself to the boss. He should have thought over the boss's ideas and studied them and tried to see if he could not work so that he could fit into them. He should also have studied the boss's peculiarities and taken it upon himself to disregard their effect on him. In other words he should have cultivated a philosophy and used a little psychology on the situation and should also have used a little salesmanship. In the end, after doing all these things, he would not have resigned.

There are times, of course, when one has to resign for the sake of one's self respect. A few firms—fortunately, however, very few—are not altogether square and scrupulous, not only to their employees but not even to themselves. It doesn't pay to work for such firms. There is no prestige in belonging to them and the very first moment you can you should resign from them. There are other times when another firm will appreciate you more than does your present one. Resigning is often justified in changing from one to another. That is not resigning, in the exact sense of the word. "Transferring" is a better word to use. "Jack Jones has transferred his services as chief mechanic from Robinson's shop to the Smith shop." Even here, though, care must be exercised, because it may be only superficially that Jack is bettering himself. Some companies of doubtful or dying reputation will often pay large sums to an individual to have him come in and to help bolster up their poor fortunes. This situation means, of course, only a temporary employment and a forced resignation at the end. Whereas, if our friend had stayed on at his old company he would, in all probability, be in line for advancement.

The Risk of Being a "Floater"

Does it seem as if too much stress has been laid on "not resigning"? Let us take the case of a young man, ambitious for knowledge but cooped up in a two-by-four machine shop. Should he resign when he has learned all there is to know in such a place? Of course he should get out and travel more to gain as much experience as he can, almost, even, at the risk of being termed a "floater." But, and it is an important "but," he should first make sure that it is actual experience he is getting and not just change of scenery. Nor should he pursue this course too long. Five years, corresponding to the old five years' apprenticeship, followed by the five years' journeymanship, is ample time.

Sometimes it isn't pleasant to fire a young man out of his first and only job, but many a man has been improved by the experience. The youth, though, should have had sense enough to resign first. Sometimes also he should have sense enough to know that he is not suited for the work he is attempting and that he would do better in another grade of work. In this case, also, he should resign.

Possibly in these days when cost of labor turnover brings wrinkles to the brow of the big chief, this advice will not be entirely palatable. But let the boss size up his best men, and find out how many have been improved by early and calculated resignations and he may come round to our opinion.

Resigning, like other elements, can be a source of trouble as well as a source of power. Don't resign for such motives as being peeved or sore, or because the job isn't one hundred per cent to your taste. Think twice, even thrice, before you resign, and do it then only because you have carefully calculated that it means a real advancement for you and real betterment, either morally or financially.

And when you do resign, do so with a good grace. It is a pleasant feeling to carry with you the good wishes of your past associates. Handled rightly, these men can remain among the list of your friends—real friends than whom there is no greater asset that a man can have.

A.G.M.A. Fall Meeting Papers

Measuring Gear Teeth

These papers were presented October 1, 2 and 3 at the meeting of the American Gear Manufacturers' Association, held at West Baden, Ind.

By J. L. Williamson
Research Engineer
Fellows Gear Shaper Co.

THE subject of measuring gear teeth has been so thoroughly covered in the past that the so-called conventional methods are, no doubt, familiar to all gear makers and to many users of gears who are not engaged in their manufacture. The object of this paper is to discuss some of the dimensions that are usually inspected, hoping thereby to indicate some of the difficulties that are encountered and to suggest means for overcoming them.

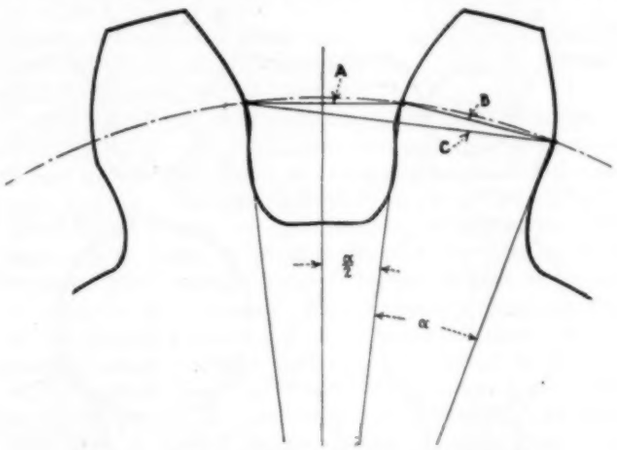


Fig. 1—Elements of gear measurement

The relation between the circular pitch, the tooth thickness, and the space width is so definite that it would seem impossible to find a discrepancy between these measurements and yet very often they do not agree. When we refer to these dimensions, as illustrated in Fig. 1, we usually mean the chords subtended by the arcs instead of the arcs themselves.

It can be seen that a definite trigonometric relation exists and that if we are to make actual measurements no discrepancy should be found. As a concrete example, let us consider a 15-tooth, 3-pitch gear. Assuming the space to be 0.004 in. too wide, the circular-pitch chord should be 0.00394 in. too long. The difference is only a little over 0.00006 in., and, because most testing machines will not indicate so slight an error, we should probably say that the 0.004 in. found in the space width was also found in the circular pitch.

Usually, however, we do not make actual measurements but instead we check the variation in tooth thickness, space width, and circular pitch by taking relative readings. We set our fixture for checking the thickness of teeth *near* the pitch line. Another setting is required for the space width which is also taken at a point *near* the pitch line. Then still another setting is required for a comparison of the circular pitches on one side of the teeth and a slight changing over of the machine to check the other side. These readings are also taken in the vicinity of the pitch line. When we have finished, perhaps the lines indicated in Fig. 2 are the ones we have measured.

It is apparent that effort spent in trying to compare these readings would only be wasted and yet the values for each dimension taken separately tell us much about the physical characteristics of the gear. Let us consider some of the factors which have entered into our measurements and find the reason for the conditions indicated.

The thickness of a tooth is frequently measured from the top by use of a templet or a tooth caliper. It can readily be seen that the outside diameter, its concentricity with respect to the bore, the number of teeth, and the pitch all affect this measurement and make it necessary to introduce certain correction factors. Sometimes these factors are very simple and can be safely used, but more often they result from such a complex relation that perfect correction is almost impossible.

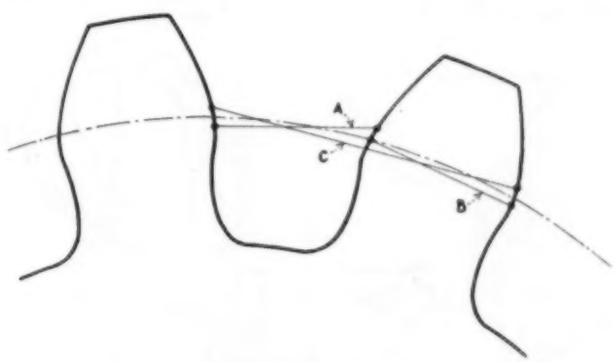


Fig. 2—Measurements used in checking

Another method for checking tooth thickness or space width requires the use of a micrometer fitted with V-blocks to represent rack teeth or spaces. These

attachments are made to the correct pressure angle and of such thickness that a normal reading gives the diameter of the pitch circle. This method also has certain disadvantages in that a wide space opposite a narrow space might show the correct over-all dimension

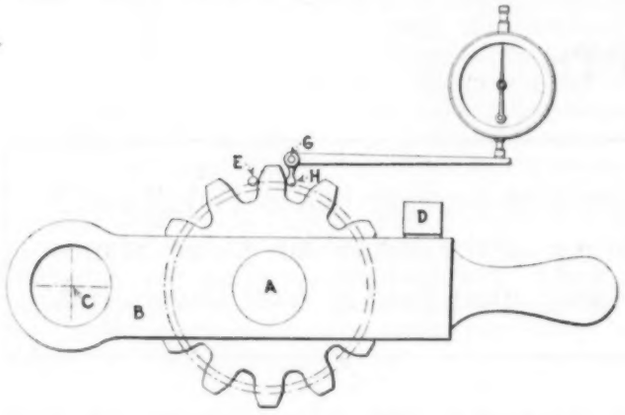


Fig. 3—Apparatus for checking at constant center distance

and not indicate the errors. In addition to this, if the involutes were not correct, the measurement would not equal the pitch diameter, notwithstanding the fact that the spacing might be perfect.

The practice of measuring these dimensions at a constant distance from the center of the hole eliminates many of these objections. By referring to Fig. 3, you will note that the gear to be tested is mounted on stud *A* which is attached to handle *B*. These move about center *C* until the handle contacts with stop *D* and the tooth to be measured is between points *E* and *H*. *E* is in a fixed position and *H* is free to move about center *G* on the arm.

While this method may not be absolute when only one of the points is free to move, the correction is so slight that it can be safely neglected. The same fixture can be used to check the width of space by simply bringing *E* and *H* closer together so that they will enter a space with *E* contacting on one side and *H* on the other. The necessary adjustment should be made at *D* to allow *E* and *H* to touch the teeth at the pitch line if these variations are to be compared with the circular-pitch test.

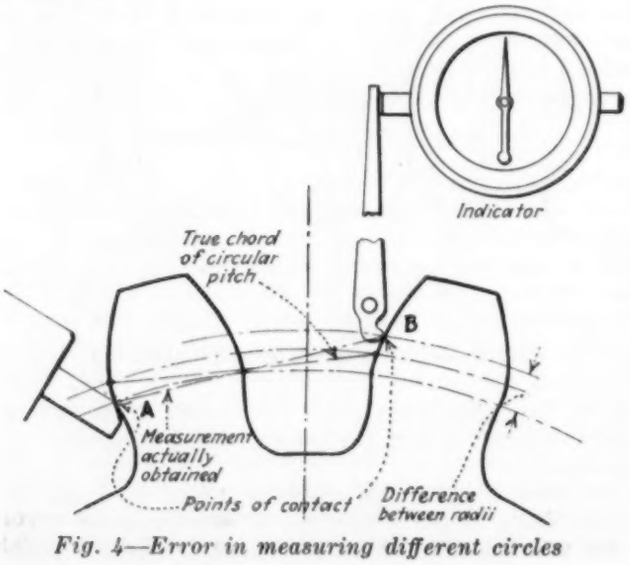


Fig. 4—Error in measuring different circles

This is one of the most important dimensions to check. Sometimes an exact measurement is made on the pitch circle, but usually little attention is paid to this, and comparative readings are taken on any circle. This in itself would not be serious were it not for the fact that very often one of the points is on one circle and the other point is on a different circle. An example is shown in Fig. 4. Here is given a condition which is seriously affected by the profiles. We may get a relative spacing test, but the errors indicated may not be spacing errors. They may be variations in the involute. Perhaps this could be detected by checking at various points on the tooth; one near the pitch line; one near the top; and one near the bottom. If, however the variations in circular pitch are to be compared with tooth thickness and space-width readings, all measurements should be made on the same circle.

The eccentricity of a gear is often checked by placing a ball or master rack tooth in each space and noting changes in the distance from the center of the bore to the points of contact. Obviously this is affected by errors in spacing and profiles, which are usually indicated by abrupt changes whereas eccentricity alone causes a regular movement of the needle from zero to the highest reading and back to zero. If a ball is used, doubtless the thing that should receive the greatest attention is its diameter. If the ball is so small that it contacts too near the bottom of the space the movements of the indicator are very easily misinterpreted. By referring to Fig. 5 it will be seen that a slight spacing error will allow the ball to enter the space to a considerable depth and the eccentricity of the gear will have very little effect on the indicator. Carried to the extreme, if the teeth had parallel flanks and the diameter of the ball were the same as the width of the flank, the slightest addition to this width would allow the ball to drop to the bottom of the space notwithstanding the fact that it might be on the high side of the gear. At *C* and *D* in Fig. 5 these are shown.

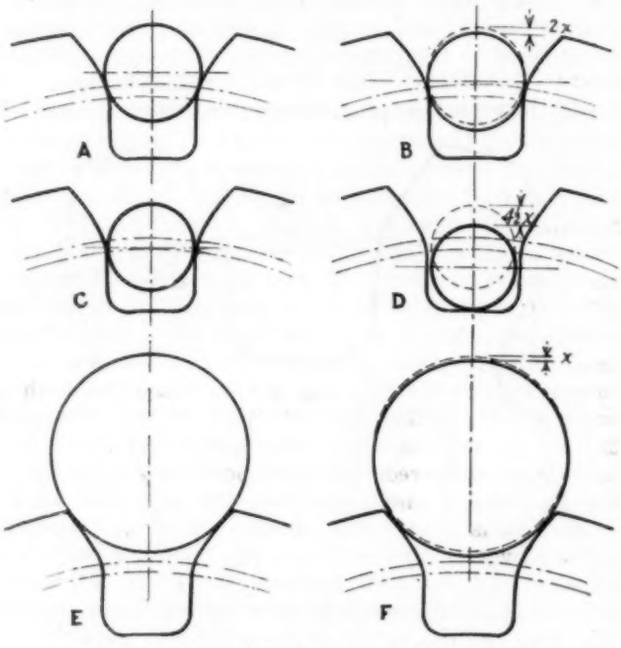


Fig. 5—Use of balls for checking teeth

In order that the eccentricity may have a greater effect on the indicator than the errors in spacing, we

should use the largest possible ball that will not make contact with the corners or at points where the involutes have been relieved. Conditions at *E* and *F* should be compared with *A* and *B* which show a ball

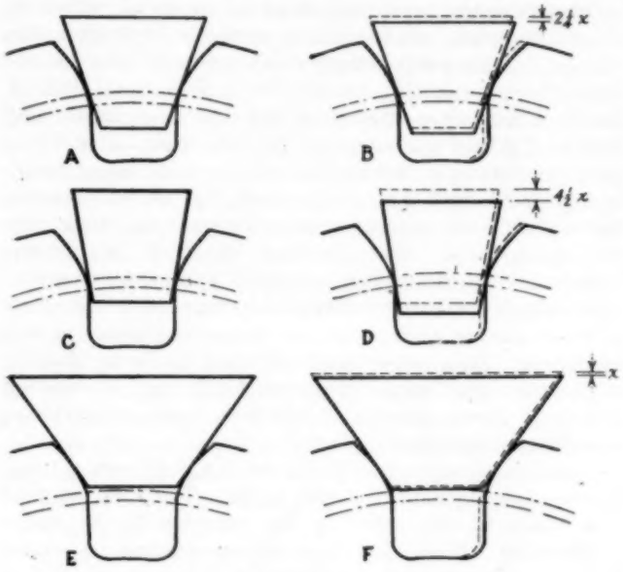


Fig. 6—Using master rack teeth

in contact near the pitch line. It will be seen that the ball has dropped approximately two times as far at *B* for the same error in spacing.

The same general condition is present if a master rack tooth is used. The illustrations in Fig. 6 show the effect of spacing errors on rack teeth of various pressure angles. The condition at *C* and *D* is very different from that shown in the previous illustration. The increase in space width has allowed the rack tooth to enter a little farther than at *B* but it does not touch the bottom of the space. Fig. 7 shows a condition that is not always appreciated. The point of contact on the tooth surface changes with every variation in spacing, if the ball is used, but it does not change as the rack tooth moves in or out from the center of the bore. The line of action always passes through the center of the ball and is tangent to the base circle. As the ball changes its position with respect to the center of the gear the angle of the line of action must also change. In the case of a rack tooth the line of action is always perpendicular to the side of the tooth and since the side is straight, the angle of the line of action is constant.

The following conclusions can be drawn from the foregoing:

1. To check eccentricity the points of contact should be as near as possible to the ends of the teeth.

2. To check spacing the points of contact should be near the pitch circle.

4. Comparative readings cannot be obtained on different testing fixtures unless the diameter of ball is the same on both machines.

4. Comparative readings cannot be obtained on different testing fixtures unless the pressure angle of the rack tooth is the same on both machines.

Sometimes a gear is tested for eccentricity by engaging it with its mating member, without backlash, and by noting changes in the center distance as the teeth pass through mesh. It is conceivable that the eccentricity of one might offset the eccentricity of the other. Often the second gear is a master of known proportions. While this is preferable, all changes in center distance are not entirely due to eccentricity as the other teeth in the arc of action influence the movement of the free stud. These methods are likewise affected by errors in spacing and profiles.

The normal involute pitch is the length of the arc of the base circle between corresponding sides of adjacent teeth. If the involutes are correct, the distance between the profile is the same on any straight line which intersects both curves and is tangent to the base circle. If this dimension is used to compare the spacing or profiles the measurements should be taken at several points along the tooth surface.

There are involute testing machines, the designs of which are based upon the geometric properties of the curve. If the machines are sufficiently sensitive it is possible to take very accurate readings of the profiles of an involute gear tooth from the base circle to the top. The curve is not affected by errors in tooth thickness or spacing for the reason that an involute can be generated through any point on the base circle. Because of this fact, we should have more confidence in this reading than any of the others.

The few cases cited above are sufficient to suggest the need for highly trained inspectors. Some of the essential qualifications are:

1. That he be thorough as well as highly skilled in the use of inspection equipment. He should also have a desire to understand the theories which form the basis of his practice.

2. That he have a receptive mind, since many valuable suggestions are received from unexpected sources.

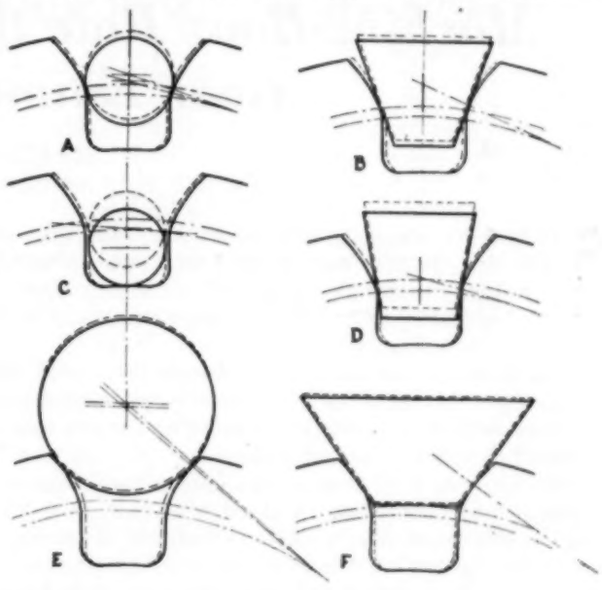


Fig. 7—Comparison between ball and rack tooth for checking

Ideas should be carefully considered before they are condemned.

3. That he have an analytical mind and adopt no new method before its value is proved.

4. That he have creative ability, be able to develop new methods and to improve old ones.

5. That he have a keen appreciation, since errors are possible with the best of measuring fixtures. This

condition will continue just as long as the human element is involved.

6. That he have a co-operative spirit and see that the plans and specifications of the engineering department are followed in the process of manufacture.

7. That he have an exacting nature, so limits established by the engineering department will not be exceeded.

8. That he be tactful in order to obtain correction of work without antagonizing foremen, retarding production and destroying morale.

This list might be increased to the point where the super man would be portrayed, but he is not necessary. Inspectors in general usually possess most of the qualifications mentioned and those which are not prominent can easily be developed if careful attention is given by the proper parties.

It might follow that a well planned system of training for inspectors is the logical solution and there are many arguments that could be presented in favor of it. As long as the human element plays such a prominent part, we should first raise the standard of our inspectors if we desire to raise the standards of the inspection results produced by these men.

However, we must not make the mistake of believing that the inspector can be of the greatest value to any concern through his efforts alone. He must have the confidence and assistance of the management. Direct lines of responsibility must be established and maintained. Since the inspector's work is to see that the engineer's directions are carried out, it naturally follows that the chief inspector should be directly responsible to the engineers. He should obtain their decision on questions concerning the quality of the product or the application of general limits to special classes of work.

The same suggestions, of course, apply to any line of inspection, but the degree to which they should be carried depends upon the class of material which is being produced. Gear-cutting methods have been developed to the point where precision work can be obtained on a quantity basis. We no longer think of gears simply as a means of transmitting power and motion. While transmission is still their chief function, the nature of the application presents many interesting problems. For this reason our manufacturing limits should be based upon actual operating conditions. We should study the combined effect of the errors. This study should not be confused with the investigations which are being conducted to determine the effect of tooth shapes and errors on strength, durability and quietness. It is an entirely different problem, dealing with errors that occur in combination; such as spacing and tooth form; spacing, tooth form, and eccentricity; eccentricity and spacing.

These factors can hardly be determined from a tabulation of variations in tooth parts. The relation that one bears to the other is too complex to be easily understood. More and more we are coming to realize that the day of single-dimension measurements is fast passing and that our rejection limits should be based upon actual operating conditions.

It is not infrequent that gears that have passed inspection are found unsatisfactory for service while gears that will not pass inspection give no trouble when assembled.

Machine-Hour Rate the Ideal Foundation for Gear Estimates and Costs

By Eliot A. Kebler
President, Fawcus Machine Co.

SOME forty years ago a large foundry and machine shop felt that its cost method was good, although it showed only materials purchased, estimated labor on pipe and actual labor on other castings, the many other items of cost being omitted.

This method was changed to record the actual material and direct labor used, the factory cost, administrative and selling costs being pro-rated by the net tons of finished castings manufactured.

The absurdity of this apportionment was apparent when it was noted that an elevator cylinder cast with high-priced labor, bored, faced and drilled on expensive tools, carried less overhead (by reason of loss in machining) than a bell and spigot pipe cast one day and shipped the next. When this was corrected the true cost was so high that the use of elevator cylinders was practically abandoned. We must not forget that even today there are some concerns who judge their profits by the increase, if there is any, in the size of the bank accounts that they have acquired.

The excellent reports of our uniform cost accounting committee and the papers read before the association, clearly show that the machine-hour rate is the proper basis for pro-rating shop overhead when machines, varying widely in cost, are used.

The machine-hour rate is the relative cost of operating on production work, a bench or hand, erector, fitter or a machine, and this rating is only used to pro-rate the indirect manufacturing expense. Direct labor and direct material are, of course, charged to jobs. Administrative and selling expense is usually pro-rated by productive hours.

The chief advantage of the machine-hour rate is that each machine carries a burden proportionate to its cost of operation. For example; one company has seven rates. Rate 6, for instance, carries six times more of the actual shop overhead to the order than if a rate 1 machine had been used. These rates are fixed by a survey of the plant and by comparing the cost of operating each machine.

These costs may be obtained, for instance, by apportioning depreciation on buildings and equipment, insurance, rent, light and heat, taxes, etc., over the floor space occupied by each machine and its operator, power apportioned by horsepower, and adding for each machine its depreciation and the cost of tools used on same.

The machine-hour-rate plan is particularly advantageous in that very expensive machines carry their true

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shop burden instead of the same as that of a fitter or a small drill press.

In preparing an estimate for bidding, it is necessary to know as closely as possible what the cost will be. If costs are based on the machine-hour rate, it is, of course, necessary to use machine-hour rates in figuring estimates, for it is self evident that the basis of each should be the same, if uniformity is to be expected.

While there are a number of factors entering into the determination of the proper price to quote, if we have before us, as a basis, an estimate that will closely approximate the cost if the order is secured, there certainly would be fewer ridiculous bids, and the business secured would be more profitable than under the present unsatisfactory conditions.

The Chamber of Commerce of the United States gives the following advantages, among the many obtained by uniform cost accounting:

"1. It provides the 'one best way' known to the industry to figure costs (although provision should be made for keeping the uniform methods up to date), thereby eliminating expensive experimentation by the members of the industry individually and independently.

"2. It results in better informed competition within the industry.

"3. It enables the industry instantly to place facts before regulatory bodies.

"4. It inspires confidence in the public that selling prices are established by producers who have full knowledge of the costs of the articles offered for sale.

"5. It tends to make the manufacturer, who otherwise would fail to see the advantages of good cost accounting, convinced of the desirability of adopting the methods which his competitors are successfully using.

"6. It reveals the lines of individual products which have been marketed on an unprofitable basis.

"7. It provides, in addition to the above specific reasons, all of the valuable features of good cost accounting generally, among which are the following:

(a) It shows the danger line below which goods cannot be sold at a profit, thus serving as an insurer of profits.

(b) It acts as a guide to the value, efficiency, and waste of workers, machines, methods, operations, and entire plants.

(c) It provides a reliable guide and basis for estimating the cost of prospective business.

(d) It furnishes current reports for comparing major cost items with standards which are predetermined and thereby measures and increases operating efficiency.

(e) It establishes a standard manual of accounting practice, so that if your cost clerk, book-keeper or accountant leaves you, his successor will find a system, the operation of which, has been fully and completely developed."

I heartily agree with Mr. Dunn's remarks made at the 1922 meeting, held at Buffalo, N. Y., that the association employ an outside accountant to travel around for a year among the various companies and spend all of his time on cost proposition.

The accountant, of course, must co-operate with our uniform cost committee, to see how our recommended cost practice method, or a modification of it, could cover the requirements of our members.

Some Recent Developments in Gear Research

By E. W. Ham* and J. W. Huckert†

THE gear research recently undertaken by the authors at the University of Illinois has for its object the determination of the efficiency and durability of spur gears. The results of these experiments are reported in Bulletin 149 issued by the Engineering Experiment Station. The apparatus used consisted chiefly of the gear-testing machine designed and built by Wilfred Lewis, for the University in 1916. The machine is used principally on tests for the determination of the efficiency and the wear of unhardened gears. It is recognized that the refinements of manufacture of modern gears render the question of efficiency of little practical importance, but since the Lewis machine was so well adapted to the reliable determination of efficiencies and since so little published data were available and such diversity of opinion existed, a very thorough investigation of the efficiency was undertaken with the apparatus and material that were available.

It was also recognized that wear data on hardened gears would be in greater demand than on unhardened gears. But it seemed a logical procedure to first study the behavior of soft gears. Moreover, when hardened gears wear to any considerable amount, the failure is due either to heavy loads that squeeze out the lubricant or to high speeds that throw off the lubricant. As a result the gears heat up to a point where the temper is drawn and the gears are reduced to a soft condition. The change in the tooth profile is due to wear, that should be of the same character as that for soft gears. Tests on soft gears should give a true indication of the change of tooth profile due to wear for all kinds of metal gears. The efficiency of unhardened gears should also be practically the same as that for hardened gears, provided, however, that the comparison is made before the unhardened gears wear appreciably.

The examination of each of the factors, such as speed, load, pitch, gear ratio, tooth form, and lubrication were held to definite limits which were considered consistent with the testing apparatus and the conditions under which the tests were to be conducted.

The gears that were used in the tests on the Lewis gear-testing machine were furnished by the Brown & Sharpe Manufacturing Co., the Fellows Gear Shaper Co. and the Gleason Works, and they were cut in accordance with good commercial requirements, no attempt having been made to secure extra refinements in manufacture.

The air pressure which produced the load on the teeth was controlled by regulating apparatus so that any desired pressure could be held on the teeth for any desired period during an efficiency or durability test. Tooth loads up to 1,500 lb. per sq. in. of face were used for the efficiency tests, while for the wear

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*Associate professor of machine design, University of Illinois.
†Assistant professor of mathematics, University of Louisville.

tests, the teeth were subjected to steady loads of 1,000 lb. and 500 lb. per inch of face for the 1- and 2-in. faced gears respectively. Pitch-line speeds varied from 60 to 1,500 ft. per minute.

A medium engine oil was selected as the lubricant and delivered to the teeth at the pitch line where the gears went into mesh. This arrangement, though less desirable, in some ways, than an oil bath, provided a regular and uniform flow of oil under constant head and therefore standardized the conditions of lubrication. A suitable instrument was devised for the measurement of the tooth wear.

In this investigation an efficiency run consisted of a series of tests in which readings were determined while the gears were run at a constant velocity, the load on the teeth being increased by small increments. At the beginning of such a series, the machine was run with no load on the teeth and the reading of the scale recorded. This reading, designated as the zero reading, represented the effect of all machine friction; namely, the frictional resistance of the bearings, the air resistance and the tooth friction due to idle running. Then with all other conditions remaining unchanged, a small load was put on the teeth. The load on the teeth increased the scale reading over that due to idle running and the difference between the two readings represented the tooth-friction load. By again increasing the pressure, readings for another determination of efficiency were obtained. The whole series constituted what was termed an "efficiency run."

A preliminary study led to the selection of a tangential load of 1,000 lb. on the teeth as the standard load and a pitch-line velocity of approximately 700 ft. per min. as the standard velocity. Since the master gear had a 2-in. face and the test gear a 1-in. face, the loads per inch of face were 500 and 1,000 lb. respectively. This enabled a comparative study of tooth widths to be made and gave some idea of the effect of tooth load on wear.

The following is a summary of our conclusions on the tooth-friction efficiency of gears:

1. The efficiency of unhardened gears is practically independent of the quantity of oil used for lubrication, provided that the quantity is sufficient to prevent heating and cutting.

2. The efficiency is independent of the speed within the range covered by this investigation; namely, a pitch-line speed of 60 to 1,500 ft. per minute.

3. The efficiency does not appear to be influenced by the obliquity of action.

4. For all practical purposes the efficiency is independent of the load transmitted. The value of 99 per cent is suggested for use in computations dealing with the efficiency of unhardened gears cut in accordance with good commercial practice.

5. Condition of tooth surface is the most important of the factors which affect the efficiency of unhardened gears. Gears with rough tooth surfaces are less efficient than those in which the tooth surfaces have become glazed, but the difference in efficiency is not as great as has been commonly assumed.

6. When all other conditions are the same, greater sliding action causes the longer addendum gears to have a slightly lower efficiency than the shorter addendum gears. On the other hand, the vibration of the longer addendum gears may, for certain ratios, be so much less than that of the shorter addendum gears as to result in the slightly higher efficiency of the long addendum gears.

7. The difference in efficiency of the several standard tooth forms in common use is so small as to exercise no controlling influence on the tooth form to be recommended or adopted for any purpose.

The following is a summary of our conclusions on durability:

1. Unhardened steel pinion teeth quickly wear to outlines other than true involutes, regardless of load, speed and lubrication and after this occurs, wear practically ceases or is greatly retarded under ordinary operating conditions.

2. The teeth of cast-iron gears meshing with steel pinions fail by the crushing of the material in the region of the pitch line.

3. The teeth of unhardened steel pinions meshing with cast-iron gears fail by abrasive action which wears off the face of the tooth and hollows out the flank, resulting in general, in a final outline of double curvature.

4. Lubrication is a very important factor in the life of unhardened gears although the quantity of lubricant does not materially affect the final change in tooth outline due to wear, it postpones the beginning of a rapid wear of both pinions and gear and thus greatly prolongs the life of the gears.

5. Under the same conditions of load, speed and lubrication, the wear increases with greater sliding action but these tests indicate that the amount of sliding and the amount of wear are not necessarily proportional.

6. Combinations of factors or conditions which cause excessive vibration have a detrimental effect on the durability of gear teeth.

7. Surface pressure is the most important of the factors which affect durability. Apparently for any pair of gears there is a critical surface pressure, governed by the properties of the materials, above which the life of gears is short and below which the gears will run indefinitely without appreciable wear.

8. For unhardened gears under constant load and free from impact loads, the allowable tooth loads, based on the Lewis formula for strength, are in excess of those permissible for satisfactory durability.

9. Unhardened gears for constant-load transmission, should be designed on a basis of durability rather than of strength. A gear tooth that is durable for a given load will, in general, be amply strong.

It should be noted that these tests involved only one combination of materials, and that changes in the materials of gear or pinion may have a decided influence on wear characteristics. It is believed that these series of tests will serve as a basis for further investigations necessary in order to obtain quantitative experimental data for establishing a reliable formula or formulas, which will correlate the wearing qualities of a tooth to its size, shape, and composition under various conditions of load, speed and lubrication. This means that the ultimate aim should be, not the determination of the amount of wear in a given time or under given conditions, but the determination of the limiting conditions for the prevention of wear. A correlation of the efforts of those engaged in gear research and the outlining of a broad program for future research would unquestionably mark a distinct advance in this field of endeavor.

Automotive Production

Fig. 1—The experimental machine shop

A Modern Engineering Department

By John Younger
Associate Editor, *American Machinist*

A self-contained department—The use of machine tools—The equipment for testing chassis parts—The type of building for research

FEW engineers have research departments entirely satisfactory to them, but the White Motor Co. has an engineering building and equipment of which any engineer would be proud.

The engineering building is a modern brick structure, 150 ft. long by 160 ft. wide, that was completed this spring, and in it are housed the various subdepartments that go to make up a modern engineering laboratory. The sub-departments have been skillfully arranged to establish close contact between those divisions which are closely related. For example, the office of the patent attorney adjoins the designing room. In this way he is enabled to keep in constant touch with the work that is on the drafting tables and to easily determine whether the new design is a patentable one or whether it is advisable to change it in view of possible infringement. Another example of proper grouping is the placing of the dynamometer control panel and all testing and measuring devices accessory to the dynamometer near each other so that they can be readily supervised by the laboratory observer in charge of the test.

Although the building is adjacent to the main factory, it is a completely self-contained and separate unit with its own heating plant air compressor installation, electrical sub-station with transformer room and switchboard, and similar facilities. The elevator in this building is capable of handling the largest chassis built by the company.

The engineering department has several functions to perform, one of which is the designing of changes and improvements on current models as well as work looking to the future. The production drafting department and the blueprinting room are located in the office

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building of the main plant, but are under the control of the engineering department.

The well-equipped machine shop is illustrated in Fig. 1. In order to give an idea of the equipment used and the balance maintained in the shop, a list of the machines, individually motor-driven, is given below.

1—14-in.x8-ft. American lathe
5—18-in.x8-ft. American lathes
1—20-in.x10-ft. Greaves & Klusman lathe
1—24-in.x19-ft. Greaves & Klusman lathe
1—12-in.x6-in. Hendey lathe
1—5-in.x12-in. Blount speed lathe
1—25-in.x50-in.x14-ft. Le Blond Gap lathe
2—No. 31 Lucas milling machines
1—No. 3 Cincinnati milling machine
1—No. 3A Brown & Sharpe Universal miller
1—No. 4 Cincinnati milling machine
1—No. 3 Van-Norman milling machine
1—16-in. Hendey shaper
1—24-in. Hendey shaper
1—14-in. Leland-Gifford sensitive drill
1—3½-ft. Cincinnati-Bickford radial drill
1—21-in. Cincinnati upright drill
1—14-in. Leland-Gifford drill press
1—72-in. Norton grinder
1—Heald cylinder grinder
1—12x1½x1-in. Cincinnati grinding stand
1—12x1½x1-in. Cincinnati combination grinder and buffer
1—No. 2 Brown & Sharpe surface grinder
1—Le Blond tool grinder
1—6-in.x6-in. Peerless hack saw
1—6-in.x6-in. Peerless shaping saw
2—Arbor-presses
1—Riveting outfit
1—Gas welding outfit
1—Hardening furnace

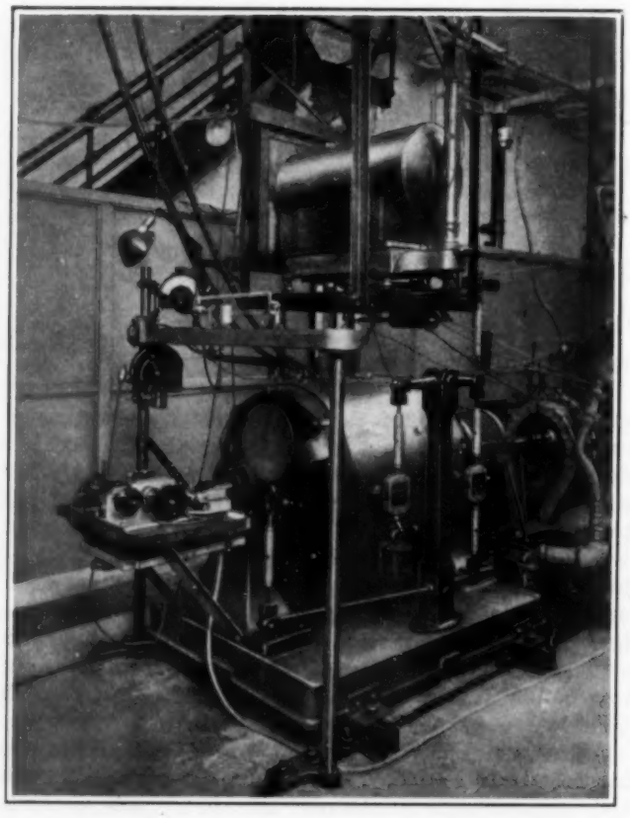

Fig. 2—The dynamometer and its equipment

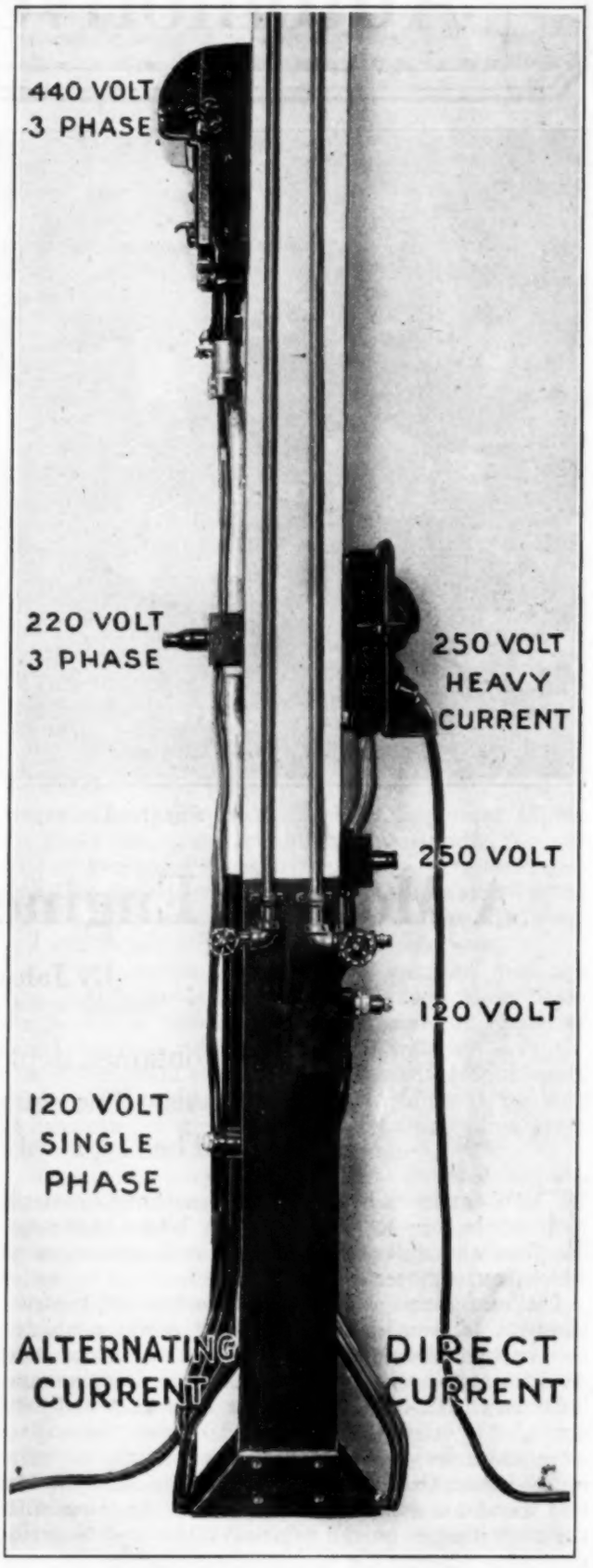

Fig. 3—The electric feeder system

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This equipment is capable of practically any shop operation with the exception of pressing, and the purpose of it is to build experimental chassis or parts models without the interruption of production plans.

It is the White Co.'s plan to always build several complete sample chassis of all new models. One of these chassis will be used for laboratory tests of the ability of the model to function and of the relative values of each factor in functioning. Another will be used for duration or breakdown tests in order to ascertain how long a life may be expected from it under heavy conditions. Additional chassis will also be tried out under practical road conditions to determine the driving reactions. Although these chassis are the ones used for the engineering tests, they are not the only ones that are built before production is begun. A number of test production jobs are sent through the shop as a final test before entering into mass production.

The research laboratory is well worth studying. Since engine testing is naturally a major function of the department, dynamometers are installed as in Fig. 2. There are three of these Sprague-type dynamometers that were manufactured by the General Electric Co., one of which is capable of absorbing 50 hp. at 775 r.p.m and has a speed range up to 2,500 r.p.m. The second can absorb 100 hp. at 1,050 r.p.m. with a speed range up to 3,500 r.p.m. and the third can absorb 150 hp. at 2,200 r.p.m. and has a speed range up to 3,500 r.p.m. One of these dynamometers is installed in a separate compartment, so that there need be little diversion from the study of the factors being examined. The floor of the entire department including the dynamometer rooms is equipped with T-slots set at regular intervals. These slots allow the convenient setting up of equipment adjacent to the testing machines without having to bolt it through the floor. The dynamometers are completely equipped for all standard tests of power and fuel consumption. The exhaust, for example, is led through a valve into a pipe connected to an exhaust fan so that the pressure in the exhaust line can be maintained, as desired, over a range from less than atmospheric pressure to several pounds.

Another advantageous system used in this department is the marking of various feed lines by different colors. Whether it be for high- or low-pressure air, gas, hot or cold water, or vacuum, each line has its identifying color. The same idea is carried out with the outlets of the five different current lines as illustrated in Fig. 3. The highest voltage, 440-volt, three-phase, alternating current has its own distinctive outlet at a customary, considerable height from the floor. The lower the voltage, down to 120-volt, alternating and direct current, the nearer to the foot of the column is the special outlet.

The chemical and physical laboratories are maintained apart from the mechanical testing room, and are engaged in the routine testing of materials for production use and in the study of research problems into new materials or heat treatments.

The engineering department is run on a budget system with a certain amount allotted each month to the operation of the department.

Automobile Body Plant Lighting

By James M. Ketch,* H. J. Thompson and E. F. Labadie†**

Automobile bodies on moving conveyors present many lighting problems — Lamp and reflector surfaces air-cleaned—Overhead trolley systems—Flood lights for ovens

THE problems of lighting automobile body plants are unique because of the following conditions:

1. The bodies in the great majority of plants are placed on a continuously moving conveyor, thus constantly changing position with respect to any stationary lighting system.
2. The important exterior body surfaces to be lighted are generally dark and vertical.
3. The trimming and upholstering of closed bodies is difficult because the bodies are moving and the best of light is required on top, sides and back of the interior.
4. The cutting and inspection of the expensive body-upholstery leathers and textiles require very good lighting because of the cost of the materials which might be spoiled, and the chance of accident from the high speed rotary cutter, or the vibrating knife which is used on certain materials.
5. The inspection of outer surfaces requires light to see:
   (a) the color of the surface, and
   (b) the exact contour and condition of the surface.

There are, of course, many departments in a body plant which have the same lighting problems as the average wood mill, metal department and stamping plant.

The interior of a dry kiln requires an intensity of illumination comparable with that common to hallways. It is impractical to place the lighting equipment inside the kilns because of wood acid vapors which attack the conduit and wire. Since light is required in the interior only when placing or pulling out trucks loaded with lumber, it is found possible to furnish the required light with flood-lights placed outside the kiln door.

The natural accident hazard of high-speed machinery

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*Illuminating Engineer, National Lamp Works of General Electric Co., Detroit, Michigan.
**Electrical Engineer, Fisher Body Corporation, Detroit, Michigan.
†Electrical Engineer, Fisher Body Corporation, Detroit, Michigan.

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common to wood mills, requires a high level of well-diffused illumination. The form in which the frame of an automobile body is built up, calls for a large number of curiously shaped hardwood pieces which are fitted, jointed, screwed and glued up to make the body frame. High-speed hand-operated wood shapers and formers are required to make these pieces. The larger body plants have adopted a lighting standard of 12 to 18 foot-candles in their wood-working departments. As to spacing, the need for minimizing shadows calls for a large number of medium-sized units, 100 to 200 watts on a 10- to 12-ft. spacing, rather than a smaller number of higher wattage luminaires, such as 500- and 750-watt units on 20-ft. spacings. Local lighting—some form of deep bowl—is frequently used at the band saws to supplement the general lighting, especially where it is necessary to accurately saw to a line, and where the direction of the light is fully as important as the intensity.

Illumination for Body Frames

The assembly of the wood frames calls for illumination of the same order as that in the machine rooms of the wood mill. Here, production is the important item, as one body is being assembled at the same time by two or three teams of men who have their jobs so divided that no pair of men is idle while waiting on others. This system is usually called progressive production.

In spite of efficient ventilation and blower systems, the air of the wood mill is always filled with fine sawdust which settles on everything. In a short time the lamp and reflector surfaces are coated with this dust, causing a loss of light and creating a fire hazard. Where compressed air is available, the dust can be blown off the lamps and reflectors daily before it has had time to bake on. An easy maintenance plan is to use a 6-ft. length of ¼-in. pipe connected to the air system by a flexible hose. A good feather duster on the end of a bamboo handle serves fairly well, although it takes a little more work than the compressed-air method.

With the exception of a few operations, the metal departments, consisting of presses, stamping machines, metal band saws, punch presses, rotary shears and welding machines, can be lighted by means of the average well-diffused system of 12 to 16 foot-candles. Bumping hammers require special lighting. These are high-speed power-driven hammers used to remove dents, dings or other irregularities from the metal panels before they are welded into the unit body form. The hammerman works entirely by the specular reflection of some low-brightness source in the metal surface. A satisfactory scheme is to locate two symmetrical angle reflectors behind the hammer directed toward the operator. Oversize angle reflectors and 50-watt all-frosted mill-type lamps are used because it is necessary to keep the filament high in the reflector, and to keep the reflector surface brightness down to 3 to 5 candles per sq. in. or approximately equal to that of the average window area.

Probably the largest sheet metal presses found in the automobile industry are in use for metal stamping in the body plants where the panels and parts of the automobile body are formed in the dies of the huge toggle presses. In addition to the high intensity and diffusion required, the problem is further complicated by the necessity of mounting the lighting system 25 to 40 ft. above the floor to clear the cranes which move and set the huge dies. A moderate spacing of 15 to 20 ft. should be used to minimize the shadows as much as possible.

One recently lighted stamping plant uses 1,000-watt lamps in mirrored glass bowls, on 20x20-ft. spacing mounted on the truss chords 40 ft. above the floor. The intensity will average 18 to 20 foot-candles in the open areas and 8 to 10 foot-candles at the die surface under the press heads. This plant has been in production for nearly a year, and as yet there has been no occasion or call for local or auxiliary lighting.

Whether the bodies are sprayed in a box-type booth or whether they are sprayed in the conveyor-type booth, the problem is to get a fairly high intensity on the vertical sides of the body. Vapor-proof luminaires are required, at least in the conveyor-type booths. The practice has been to use vapor-proof dome reflectors and bowl-enameled lamps tilted at an angle which will properly light the vertical surfaces. A system employing a row of units on each side of the conveyor line, with 200-watt units on 6- to 8-foot centers has been found sufficient. A recent installation employs 100-watt deep-bowl reflectors with bowl-enameled lamps, mounted 5 ft. above the floor and 3 ft. apart. These reflectors are located outside the booth walls and are directed horizontally through holes cut in the walls. Where box-type booths are used and the bodies rotated on a turntable, three or four 200-watt lamps in vapor-proof domes will furnish a fair illumination. As in the conveyor-type booth, the domes should be tipped at an angle to light the vertical surfaces.

Cleaning the Reflectors

The problem of maintenance in the spray departments is an all important one, especially in the conveyor booths, because at the end of the day, all reflecting and transmitting surfaces will be coated with the blue, gray or black pigment which is always flying in the air. This is especially damaging if it lights on the surfaces while damp as it then adheres and is very difficult to remove. Cleaning is simple, however, if all reflecting and transmitting surfaces are kept coated with a very thin film of white vaseline. These surfaces should be wiped clean each day, then coated again with a vaseline impregnated cloth.

The problems confronted when lighting the bodies on moving conveyors are essentially the same for the several important operations found there. The surfaces to be lighted are vertical and probably of a dark color, and the bodies are traveling at a slow but constant speed. In some plants the conveyor lines are close enough so that one side of two lines, or the bodies on both sides of the work aisle, can be lighted with one line of luminaires in the center. In many plants, however, the lines are too far apart to be effectively lighted by one line of lighting, and each side of a conveyor line must be considered as a separate problem. This requires duplicate lines of reflectors in each aisle.

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One company flows enamel on the bodies while they are suspended by chains from a traveling conveyor and the bottom of the body is at least 3 ft. above the floor. This body height makes it fairly easy to get proper illumination on the entire side with luminaires mounted at heights of 7 to 8 ft. In other plants the bodies are mounted on trucks on a floor conveyor with the most important lower surface about 20 to 24 in. above the floor. As floor space is at a premium for automobile bodies and workmen, it seems impractical to locate any sort of lighting equipment on the floor; hence the use of low-mounted reflectors 6½ to 7½ ft. above the floor is more common than the use of those mounted at heights usual in factories. The intensities required are high. Levels of 20 to 50 foot-candles are standard for black, blue and dark gray jobs, while intensities of 15 to 35 foot-candles are sufficient for work on the lighter blues, grays and gray-green colors now so popular. In general, body conveyor-line lighting requires special equipment and there is a wide field for the development of reflectors that will do the job with utilization efficiencies obtainable in other and more common industrial lighting systems. With the commercial equipment now available, angle reflectors seem to give the best results. The standard of one large body company is to use 300-watt elliptical angle reflectors mounted 6½ to 7 ft. above the floor, and spaced 21½ to 3 ft. apart alternately facing opposite sides of the work aisle, thus giving an effective spacing of 5 to 6 ft on any one side. Where color is very important, 300-watt bowl-frosted daylight Mazda lamps are used, and 300-watt clear lamps where the intensity is of more importance than the color. The elliptical angle at this height, directs a high percentage of vertical illumination to the side panels and yet has a deep enough shielding angle to eliminate objectionable glare to anyone facing the row of units from the opposite side of the conveyor line.

Trolley Lighting Systems

Many schemes and devices have been tried for lighting the inside of closed bodies in the trimming and unholstering departments. While it is possible to light the body from stationary lighting systems, such systems generally prove impractical because of the need of plenty of man space in the aisles between the conveyor lines. Where the bodies being trimmed are stationary, it is undoubtedly the most satisfactory plan to use portable extension cords or portable floor stands. In the larger plants, however, the trimming is done while the bodies move along on the conveyor line and extension cords attached to stationary outlets are generally in a hopeless tangle. The plan of lighting the dome and side-lights of the automobile by means of a third rail and sliding collector system attached to a low voltage system has been tried. However, the voltage drop, due to poor sliding contacts and the resistance of the long steel tracks, has almost discouraged this practice. A better plan is to install an overhead hard-drawn copper-wire trolley with simple sliding collectors attahed to the ends of extension cords. These collectors can be cheaply and simply made and their operation has been satifactory. As the car moves along on the conveyor, the extension cord in the car slides the collector along the trolley eliminating the usual tangle of cords where stationary outlets are used.

One large company impresses the regular 110 to 120 volts of the plant on their open trolley wire, thereby enabling them to use the same voltage lamps as are regularly used in the plant. It is entirely conceivable, however, that in some cities the local safety rules might require a lower voltage of 28 to 32 volts on the trolley; in which case the regular 28- to 32-volt country-home-lighting lamps could be used.

Short-Circuit Protections

In using this device the trimmers wrap a piece of tape around the cord near the socket and tack it to one of the wood braces in the body top where it takes care of itself until he has finished with that body. Gathering up cord and tools, the trimmer merely lifts the collector off the trolley and moves back the line to a new body. At first, the trimmers did not entirely understand the trolley system and would short circuit the line by hanging metal gutter strips over the convenient bare trolley wires. Blown fuses or circuit breakers are now prevented by putting two 1,500-watt lamps in parallel, and in series with one side of the line. These lamps have large enough current capacity to carry the total current of the extension cords without lighting up, yet serve as a safety, and indicator of trouble, by lighting if the trolley is accidentally short circuited.

In the hardware-fitting department, the trolley plan is also successfully used for the small portable drills. However, some safety indicator which will carry heavier currents than the 1,500-watt lamps is desirable because an overloaded drill will virtually cause a short circuit on the line.

The leather and textiles used for body trimming are very expensive, hence good lighting plays an important part in the department where they are selected and cut to shape. One body company uses two 500-watt daylight lamps in Glassteel Diffusers over each leather inspection bench. In selecting leather, both the texture and color of the hide are important. Another body company employs 200-watt daylight lamps in RLM dome reflectors in their textile and materials cutting department, placing eleven units over each 50x5-ft. foot table. The reflectors are staggered so that a row falls over the long edges of the table, and are mounted 4 ft. 6 in. above the top. The intensity on the work plane will approximate 35 foot-candles. At this fairly low mounting height, probably deep bowl reflectors would be better because in the absence of bowl-enamel or other diffusing-media glare protection, a deep shielding angle is desirable.

The inspection is generally done on the textiles as they are spread out and piled many layers deep on the full length of the table; hence the illumination must be of a proper quality to easily detect flaws and dirt marks as well as to provide a safe illumination for the cutter who lays out and cuts the materials into many hundred odd-shaped pieces with a high-speed motor-driven rotary blade or vibrating knife. A cut finger would be painful as well as spoil many dollars worth of textiles and leathers.

AUTOMOTIVE PRODUCTION

A well-made automobile body is inspected not once but many times, and as scratches and dings may occur any time during its manufacture, it is important to catch and correct flaws before more valuable time has been spent on the finish. The bodies then, are inspected almost continuously or at the end of every important operation. This is usually done by men who carry portable cords and a light weight deep-bowl reflector with which they inspect all of the finished surfaces for off-color marks, drops, sags and dents. At present the reflectors are fitted with 200-watt daylight lamps. There is, however, now being developed a very light aluminum-bowl reflector, with handle attached, which will correct the quality of the light to a near-daylight quality by absorbing plates. This equipment will be built for 300- to 500-watt clear lamps, as a very high intensity on the body is necessary. Another form of inspection, that of determining the continuity of body curves and surfaces, is at present chiefly done by daylight. The inspectors catch the reflection of a window in the body surface, and by watching the movement of the reflected parallel line window bars as the head or car is moved, they can determine the surface condition. It is conceivable that an artificially lighted tunnel or room can be arranged to duplicate this effect as well as make this form of inspection independent of time and weather conditions.

Abstracts

from other publications

Polishing Packard Parts

Polishing is performed solely to produce an attractive appearance and the appearance is always a big factor in a motor car. This article, by Fred B. Jacobs, is descriptive of the polishing methods and equipment in use at the Packard Motor Car Co., Detroit, Mich. This company's entire polishing and plating department occupies 15,000 sq.ft. of floor space and is under the direct supervision of an expert of long training. About 600 different parts pass through the polishing room which has 100 polishing and buffing wheels in constant operation. Polishing wheels are operated at an approximate peripheral speed of 8,000 ft. per minute and buffing wheels are run at 10,000 feet.

The line shafting is located under the floor so that the absence of belts, which keep dust in constant circulation, results in unusually clean conditions. Each polishing and buffing wheel is confined in a hood that is connected to an exhaust system of approved design. Two motors, each of 75 hp., operate blowers, one on either side of the polishing room basement. The motors are directly connected to the blowers. The discharge is through a 36-in. uptake which runs to a separator located on the polishing room roof. Great pains are taken in setting up the wheels, for if this is not done properly the abrasive expense is abnormal. In general, all grain of 120 grit and finer is Turkish emery. That coarser than 120 is alumina.

Only enough glue to last a day is made up at a time for glue that is permitted to remain heated for any length of time loses its strength. The setting-up process itself is simple since it consists of coating the wheel with glue and rolling it in a trough of abrasive. In some cases one coat is sufficient, though sometimes two or more coats may be necessary. It depends on the work the wheel has to do. The majority of the wheels used at the Packard plant are of stitched canvas. They are procured in sections and made into wheels for various purposes by a special process. Care is exercised to make sure that all polishing wheels are in static balance.

Aluminum is an easy material to polish in respect to its weight as compared with other metals, but the fact that the abrasive is likely to "drag" and leave objectionable scratches is a detriment. Dragging, however, is overcome by eliminating dry operations altogether. Thus oil finishes always are in order. The first operation, which is illustrated, consists of polishing on a canvas stitched wheel, 14 in. in diameter, set up with No. 120 material. Then a wheel set up with No. 150 grain is used. The third operation consists of buffing on a muslin wheel, tripoli being applied as the abrasive, while the final step is coloring on a muslin wheel with rouge.

The article is well illustrated and very detailed in its description of various polishing operations.—*Abrasive Industry*, September, 1925, p. 264.

Front Axles

R. L. Rolf, metallurgist, Columbia Axle Co., discusses the various types of front axles and the "Witherow" process for forging axle centers. With this method the front-axle blank is broken down from 4x4-in. billets into a convenient shape for forging by several passes through rolls. The channel is rolled in place, and the ends are so designed that they may be forged into the desired shape under a drop hammer. The blank is next heated and blocked. From the blocking impression it is transferred to the finished impression in the die where it assumes its final shape. From this operation the unit is placed under a trimming press, the flash is removed and in a separate operation the spring pads are padded. These pieces are forged one end at a time, and are usually held from $\frac{1}{2}$ to $\frac{3}{4}$ in. short between the king-pin bosses. This allows the axle center to be stretched to length later on by either a press or bulldozer. After the stretching operation the I-beam is transferred to the heat-treating department where it is normalized, quenched, drawn and given a 100 per cent Brinell inspection. It is then stretched and taken to a bench where the rock from the beam is removed and the king-pin bosses placed in proper alignment. All parts are then pickled and transferred to the rough inspection department where they are inspected for burns, seams, laps, overall length, angle of king-pin bosses, depth and width of channel and flatness of pad. No beam is allowed to pass that shows more than $\frac{1}{16}$ in. rock on the spring pads, or that is more than $\frac{1}{16}$ in. undersize on the depth or width of the channel section.

The axle is then ready for the machining process. —*Forging-Stamping-Heat Treating*, Sept. 1925, p. 293.

Checking Mechanical Design in the Physical Laboratory

By J. A. Capp
Engineer, Testing Laboratory, General Electric Co., Schenectady

Importance of having designer present at tests to destruction—Examples to show how physical laboratory can aid the designer—How to write reports

THE proportions of mechanical units intended to resist stress are usually obtained by calculation, using mathematical formulas derived from well-known principles of mechanics. When the unit is of complicated form or is itself built up of many parts—and perhaps even of several different materials assembled together—the application of directly derivable formulas may be so difficult as to amount to a practical impossibility. Here, empirical formulas based on experience are often available. In the design of many mechanical units the designer is well supplied with the information of previous experience and can proceed with confidence. Not only has he his own experience to draw on but also the combined experience of many other designers and engineers as recorded in books, technical magazines and the transactions of engineering societies as well.

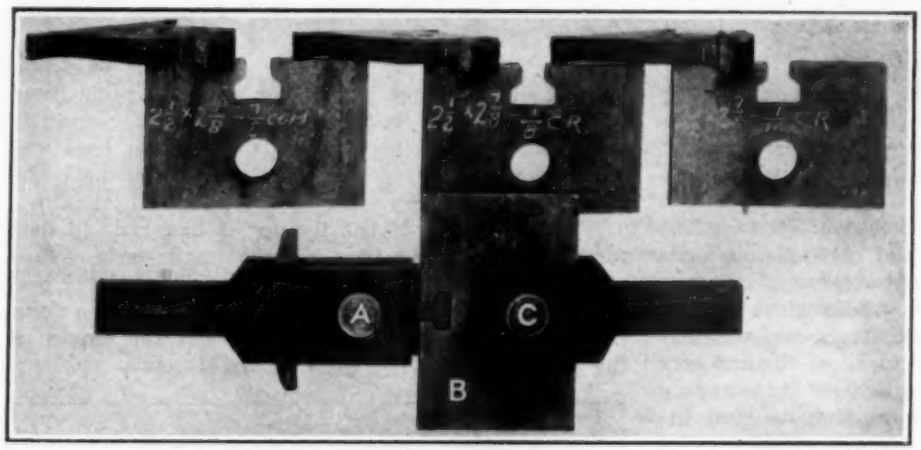


Fig. 1—Test specimens and assembly of parts for dove tail test

There are fields of mechanical design, however, in which little information is available and direct experience lacking. Under such circumstances, it is very helpful to test out the details of design very thoroughly in the physical laboratory to make sure that whatever assumptions made were justified. A series of such tests to check design frequently leads to the development of empirical formulas which are reliable, and experience may be gained in a short time which might require years to obtain under ordinary conditions of service. Sometimes, failures may be avoided by so testing out a promising design which develops unexpected weakness. The problem for the laboratory is to provide a method of supporting and stressing the machine or part so that the operating conditions under which it must function are duplicated as nearly as possible in the test. This permits observation of the behavior of the machine or part under stress, the measurement of amount and character of yielding to stress and shows the mode and place of failure. It is of the utmost importance to have the designer present at the test to see for himself exactly what happens to the "child of his brain." If he gets only a formal report of the test or even a complete story of it from the laboratory observer the impression on his mind will be much less vivid than the effect of actually seeing the device go to pieces under his own eyes. He may have the greatest faith in the man that made the test but it is far better for him to see for himself.

Formerly, the testing laboratory was looked upon only as a place where it was possible to determine strange but useful facts concerning materials as such. But the modern laboratory should not only be prepared to supply the customary data on materials, but should be able to advise the designer the probable behavior of different materials under given conditions of service and thus assist him in selecting materials, and it should also be prepared to make reliable tests on engineering structures or their parts which do not easily permit of mathematical analysis. For this work, such methods as the optical testing of Coker are valuable when they can be applied. For example, the optical method yields information on the relative stresses in various parts of the teeth and body of gearing, which it would be extremely difficult to obtain in any other way. But these tests cannot be made successfully on structures composed of several different materials and they are frequently difficult to apply to even relatively simple forms of construction. Structures should be tested to

failure not only to determine the weak points but also to show the manner of failure, which is not necessarily fracture but may be only deflection or distortion.

The routine work of testing engineering materials is comparatively simple, as the technique has been standardized and the few testing machines needed are not particularly elaborate or expensive. The testing of machines or structures of unusually large pieces may be a very different matter. Here, ingenuity may be

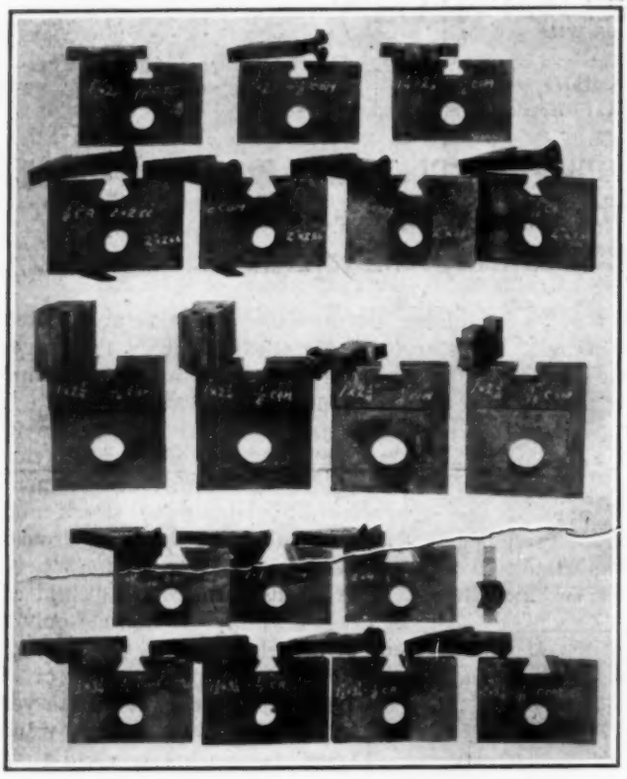


Fig. 2—Types of failure from dovetail test

severely taxed to find ways and means of securing the object in the testing machine and of applying loads to it in such a way as to duplicate the application of stress in actual service. The measurement of the amount of yield under increasing stress is frequently difficult but is very necessary. Sometimes the ordinary devices, su h as the extensometers used on standard test specimens or the dial gages reading to 0.001 in., may be used, but frequently these may not be applied and recourse must be had to any other means available in order to give a reasonable approximation of the amount of yielding or distortion under stress. For example, sometimes it is difficult to measure, by any of the usual devices, the increasing separation of two parts held together in the object under test. A crude idea may be obtained by observation of the increasing width of the line of light which may be seen between the two parts when the room is darkened and a strong but diffused light is held behind the object. A trained observer develops almost uncanny skill in such observations, but more nearly exact measurements can often be made with the mechanics' "feeler" gages—thin strips of tempered steel of increasing thicknesses mounted in a convenient holder. By trial, one finds that a strip 0.003 in. thick will just enter the crack, but one 0.004 in. thick will not enter without undue forcing; by this means, the progress of separation may be measured and from the data obtained a sort of stress-strain diagram may be plotted which will give the designer the needed information.

Sometimes the objects to be tested are too large to be put in the testing machine and an improvised method of testing must then be worked out. For example, it was required that the laboratory make tests on a line of cast iron sliding bases for mounting motors either on floor, wall or ceiling. The design had been carefully worked out so that each size in the increasing series would have approximately the same ratio of breaking strength to working load, and it was to determine how closely the breaking strength predicted by the designer was obtained in practice that tests were made on one of the smallest sizes, on an intermediate size and on a large size. The two smaller bases were tested in the testing machine but the third was too large to handle in the laboratory. It was bolted to a large iron floor plate in one of the shops and bolts were assembled in the slots as they would be in holding the motor frame. These bolts were long enough for attachment to saddles spanning I-beams which formed the loading levers in the improvised testing machine. The I-beams rested upon rollers carried on the top of short columns, the short end of each beam projecting over the base to carry the saddle, and the long end carrying platforms on which pig iron could be piled to apply load. In carrying out the test, piles of pig iron of roughly even weight were provided close to each platform. The short and long arms of the I-beam levers were measured and adjusted and allowance was made for the weight of the excess length of the long arm. At the signal, a pig was laid (not thrown) on each platform and loading so continued until the base failed. Then the weight of each platform was measured by a crane scale and the breaking load determined. The load on the base was the same as that due to a motor secured upside down to a base mounted on the ceiling. It is interesting to note that the breaking load of the smallest base was much above that expected, while the intermediate and large size broke very close to the predicted loads.

A good example of the testing of materials in final form is offered by a test recently made on dovetails of laminations. It was required to determine the best proportions of the three main dimensions of the dovetail; that is, the width of the throat, the length of the projection and the angle of the dovetail.

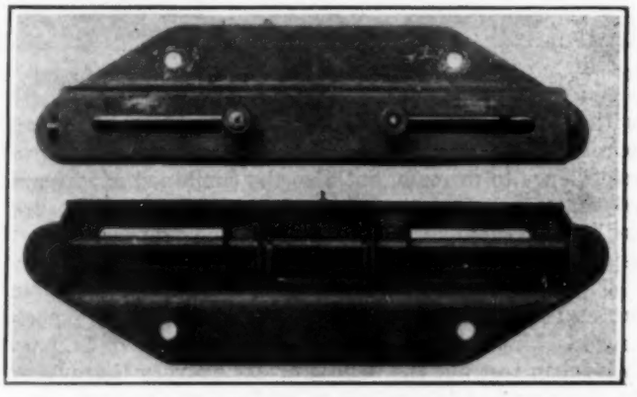


Fig. 3—Small motor rails before testing

A standard tension testing machine was used for the work, the sample being assembled as shown in Fig. 1. As will be seen, the test piece is built up of laminations varying in number and thickness and held in the special testing jaw by a pin *A*. The dovetail fits into the recess

of the block *B* which is held in the other jaw by a similar pin *C*. How some of the test samples looked after failure can be seen in Fig. 1 and also in Fig. 2.

A stress-strain diagram was plotted from readings taken at the throat of the sample and, at the same time, check observations were made by observing the gap that opened between the tongue of the dove-tail and the recess in the block. If a light is held behind the specimen a very small gap is visible to the trained

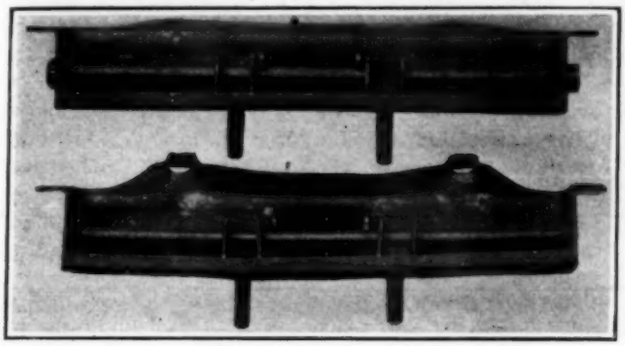


Fig. 4—Small motor rails after testing

observer. As the gap widened, feeler gages were used to measure it. The tests were finally carried to failure as indicated in the illustrations.

Two types of pressed steel rails for supporting small electric motors are shown, before testing, in Fig. 3. The same rails, after testing, are illustrated in Fig. 4. To conduct this test the rail was bolted to the table of a tension testing machine and the motor hold-down bolts were pulled at different positions along the rail to determine whether the mathematical calculations for the thickness of the material and the spacing of the holes were correct.

Another test was on large insulators of the parasol type. These were mounted first from above and tested in tension, and then as cantilevers from the side wall and tested for bending strength or deflection, the idea being to devise a combination of stem and porcelain that would permit maximum allowable deformation of the metal before the porcelain cracked. As a result of the tests, an entirely practical empirical formula was worked out upon which to develop a successful design.

In the first part of the article the statement was made that it is all-important to have the designer view the tests. It is, but this fact does not relieve the laboratory from making careful and complete records of all tests. The observer must see everything that happens and record it, and he must measure deflections at critical points. Meaningless data, and few tests are free from them, must be throw out. A real record on a test may well run to the length of a fair-sized book, but the vital facts discovered rarely cover more than a page.

In making reports of tests such as those described, or any others for that matter, there is only one safe assumption for the writer to make. That is that the reader will start the report with no knowledge of the subject and he will finish with only so much as the report actually gives him. He will not read between the lines or assume that omitted matters necessary to prove conclusions were actually known to the writer, but rather will reject the conclusions as not proved. In other words, the facts must justify the conclusions.

Precautions in the Use of Compressed-Gas Cylinders

The Interstate Commerce Commission has prescribed certain regulations pertaining to the shipment of dangerous articles by rail. These regulations include specifications for the manufacture and testing of cylinders used in transporting gases compressed to pressures over 25 lb. per sq.in. The regulations prescribe certain cylinder-test requirements which must be complied with before the cylinders are acceptable for transportation by freight or express. Tests are considered necessary in order to reduce to a minimum the hazard of having in circulation such cylinders as are not in a fit condition to withstand the service for which they are intended.

The gases which are commonly shipped in these cylinders and the intervals at which the cylinders must be tested are as follows:

Acetylene	Once—before putting into service
Anhydrous ammonia	Every 10 years
Carbonic gas	Every 5 years
Chlorine	Every 5 years
Ethylene	Every 5 years
Helium	Every 5 years
Hydrogen	Every 5 years
Hydrocarbon gases (Other than acetylene)	Every 5 years
Methyl chloride	Every 5 years
Nitrous oxide	Every 5 years
Oxygen	Every 5 years
Sulphur dioxide	Every 5 years

When cylinders have been tested, the date; that is, the month and year in which the test was made, must be stamped into the metal of the cylinder near the top.

In order to safeguard the interests of all concerned with cylinders charged with compressed gases, those who use the cylinders should observe the markings showing the dates on which the cylinders were tested. If at any time the cylinders are found to be over due for test, the owner of the cylinders should be promptly notified that the containers are not tested and marked in compliance with the regulations prescribed by the Interstate Commerce Commission.

In order to insure the greatest safety, cylinders charged with compressed air should at all times be containers that have been tested according to the above requirements. The use of cylinders which have not been so tested, whether in transportation or in service is unwarranted.

Give the Maker a Chance

The usual tendency, when a piece of equipment fails to function properly, is to look about for something that can be put in its place, something made by someone else. Its a natural tendency but one that can be unfair to the man who made the item that fell down.

Whenever a piece of equipment fails to perform, investigate the circumstances in order to determine if failure is due to weakness in the equipment or to the fact, which often occurs, that too much is being expected of it. When there is a proven weakness let the first man to know be the maker. It does not take long to find out whether he means to give constructive service or not. If he picks the latter course it is time to call on his competitors. But it costs a lot to change from one source to another, a needless and unfair waste in many cases.

Book Reviews

Cost Accounting. By W. B. Lawrence. 528 pages, 6x9 in., cloth-board covers. Illustrated. Published by Prentice-Hall, Inc., New York, N. Y. Price $5.

The scope of "Cost Accounting" can best be summarized by saying that Mr. Lawrence has written a complete text on the subject. There is painstaking care evident in each chapter to assure that the beginner who reads may clearly understand the definitions. Each point is expained, so there can be no doubt on essential classifications. In addition there are charts, diagrams and examples which are interlocked so that the student can follow the text and fix the definitions with actual figures.

No stand is taken by the author that a given phase of accounting should be carried on in one certain way. Rather, the advantages and drawbacks of the various accepted methods are compared impartially and choice is left to the reader of the one best suited for a given set of conditions.

The subject is handled in a manner that makes it adaptable for any sort of business and the book has been fitted for the manager and cost accountant by its arrangement and its index at the back, to which reference can be made to determine correct classification and procedure on any desired point of business.

Classification of accounts, manufacturing expense theory, controlling accounts and perpetual inventories, valuation of material, distribution of manufacturing expense to production, the cost to make and sell, are the headings of a few of the thirty chapters. An appendix contains sets of questions and problems and in another are grouped many practical exercises. The book is recommended.

Commerce Yearbook. Compiled by the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C. Seven hundred and eight pages, 5¼x8 in., clothboard cover. Price $1.

The volume is the third issue of the Commerce Yearbook, incorporating statistical information collected by government bureaus, trade associations and trade journals. Particularly large quantities of material were drawn from the Bureau of Foreign and Domestic Commerce, the Bureau of the Census, the Department of the Interior, the Bureau of Labor and the Interstate Commerce Commission.

The data comprise figures covering wholesale and retail farm prices, agricultural products, fuel and power, metals, construction materials, machinery, textiles, automobile products, transportation, finance and banking and foreign trade.

Figures of the outputs of these industries in 1924 as compared with previous years are shown, which should aid in planning trade relations, both foreign and domestic. The information is also intended to assist in arranging long-range programs for the stabilization of industry and trade so as to minimize economic losses.

The preparation of the text involved the co-operation of nearly every division in the Bureau of Foreign and Domestic Commerce, the Divisions of Simplified Practice of the Bureau of Standards and the Division of the Survey of Current Business of the Bureau of the Census, and marks the effort being made by the Government to better business conditions.

For the American business man, bankers, economists and trade-association executives, the volume should be of particular interest and within reach for quick reference.

The Motorcycle and Its Construction. By Curt Hanfland. Second edition of Das Motorrad und seine Konstruction, with a consideration of the side car and bicycle. 7x9 in. Six hundred and twelve pages. Eighteen construction drawings, 698 illustrations. Cloth bound. Published by M. Krayn, Genthiner strasse, 39 Berlin, W. 10. Price 38 marks.

The work is divided into four major parts with the foreword dealing with the evolution of the foot-driven bicycle and motorcycle.

The first part deals with the bicycle frame, pedal and transmission mechanism, the forks, the wheels and accessories.

The second part is devoted to the motorcycle in general, the motor, motor accessories, power transmission, frame and frame accessories.

Part three describes the side-car and its construction, and the special types of motor cycle design are considered in the fourth part.

The work is theoretical in character but thorough to the last screw. Manufacturing pointers in connecting the frame are included and this section would be found useful by tubing manufacturers in general.

The design, especially of two-cycle, air-cooled motors, forms a good contribution to the literature on this type of power.

National Foreign Trade Council. Official Report of the Twelfth Convention. Five hundred and thirty-five 6x9-in. pages. Published by the National Foreign Trade Convention, India House, Hanover Square, New York, N. Y. Price $2.50.

The Official Report covers the three general sessions of the convention held at Seattle, Wash., and includes papers on the imports and exports from and to Japan, India, China, The Phillippines, Mexico, Netherlands, Canada, East Indies and Malaysia. The addresses were made principally by men familiar with the foreign conditions and who had traveled over the fields about which they spoke. They are interesting and descriptive of conditions in general in those countries. They deal with the effect of living conditions on sales work and advertising and the effect of living conditions on foreign consumption of American goods.

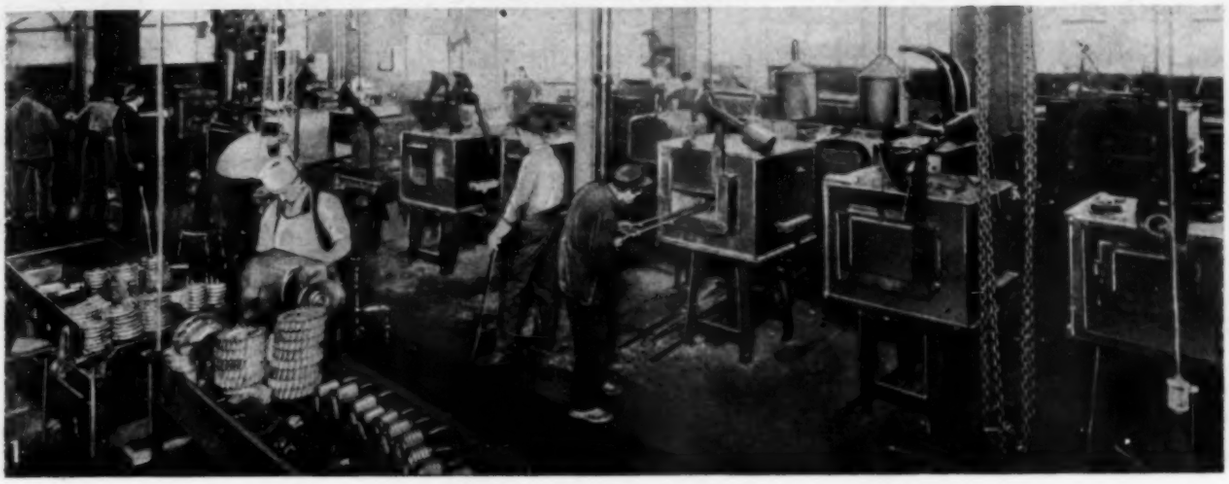
Many prominent Americans and authorities were represented on the program and natives from several of the countries gave conversational and informal talks in an able and original fashion on appropriate subjects.

The book itself forms a valuable and quite readable contribution to the literature on the status of American trade relations.

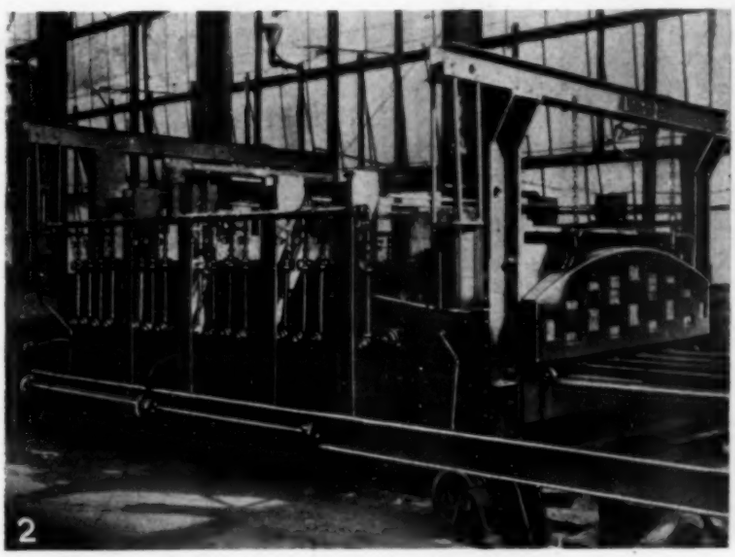
Effect of Wear on the Magnetic Properties and Tensile Strength of Steel Wire. By Raymond K. Sanford, Walter L. Cheney and James M. Barry. Scientific papers of the Bureau of Standards, No. 510. Pages 339 to 344 of Vol. 20. Price 5c. This paper reports the results of part of an investigation on non-destructive methods of testing wire rope. It relates the part that this particular branch of the investigation plays in the final results, describing the methods used.

Modern Gas-Fired Heating Equipment

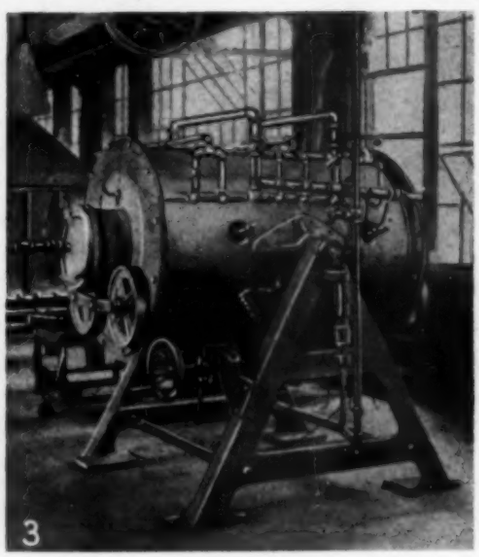
Photographs by courtesy of the American Gas Association



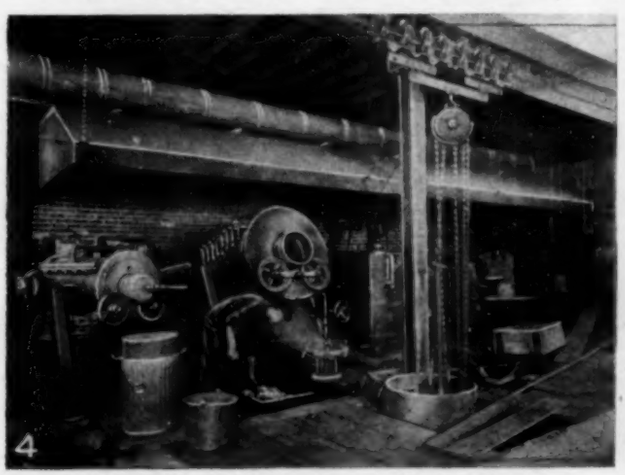
General view of the heat-treating department of a small-tool manufacturer where all classes of heat-treating are accomplished



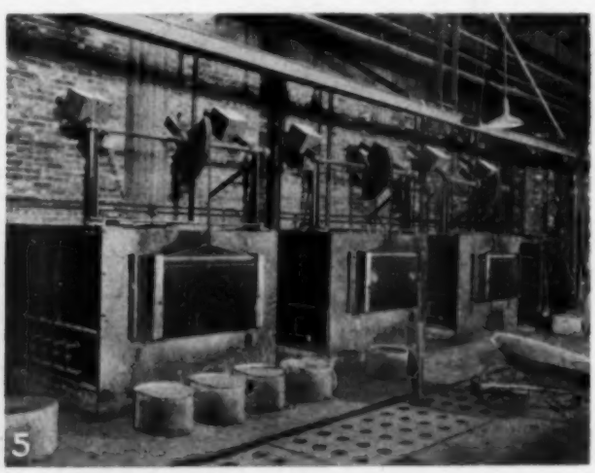
Heating furnace that consumes 60,000 cu.ft. of gas per hour. Box-car ends are heated for forming at the rate of one per minute



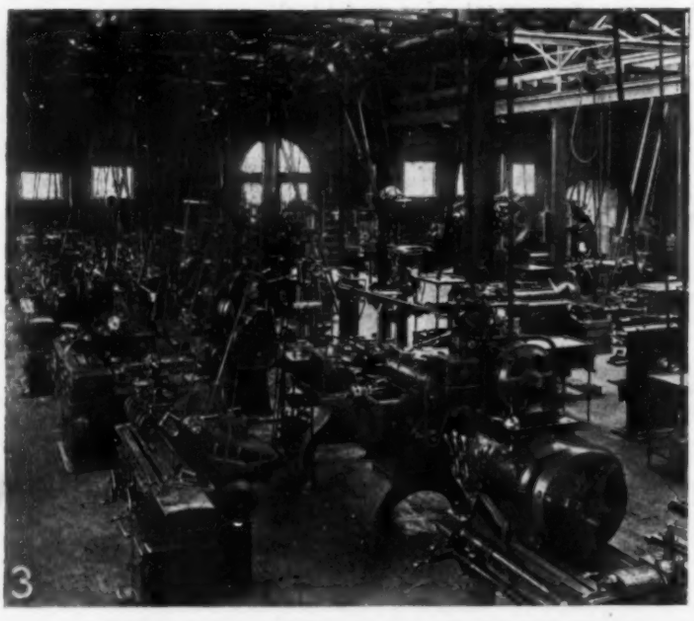
A rotary-type carbonizing machine used for small automotive accessory parts



Heat-treating department of a job shop where a variety of work is handled



Gas-fired furnaces used for pack hardening pinions and gears



Where Boys Learn

Showing the splendid and
machine shops of Purdue

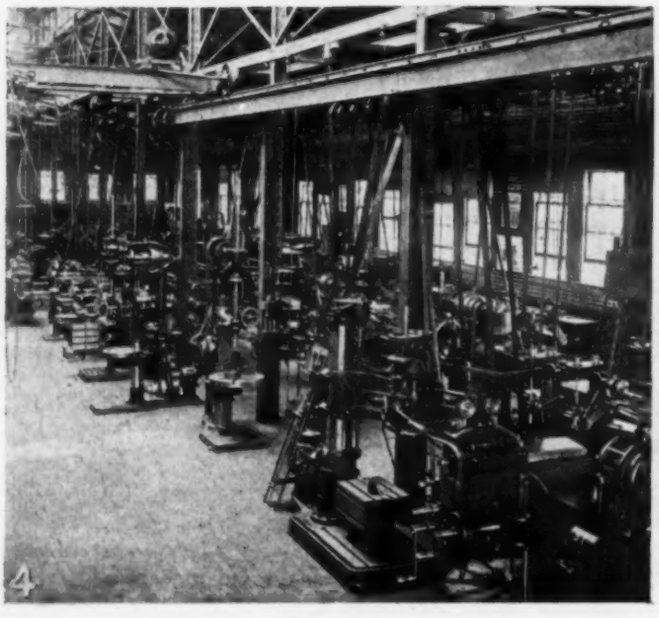
1—The lathe department

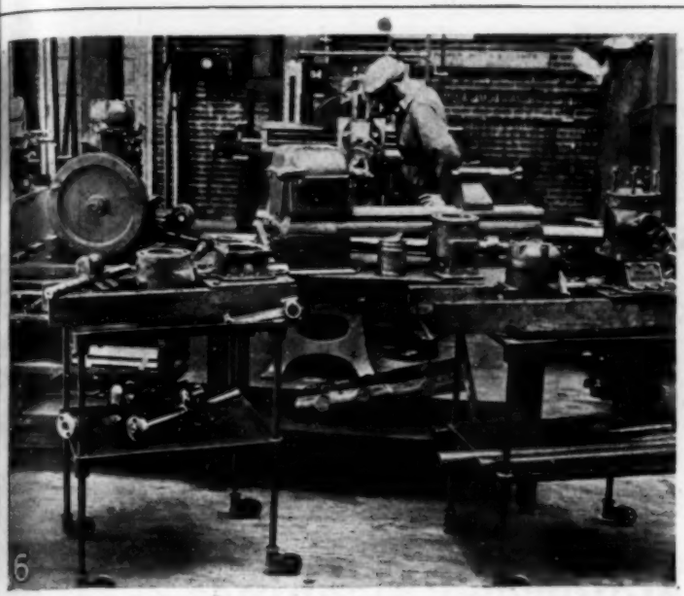
2—The milling machines

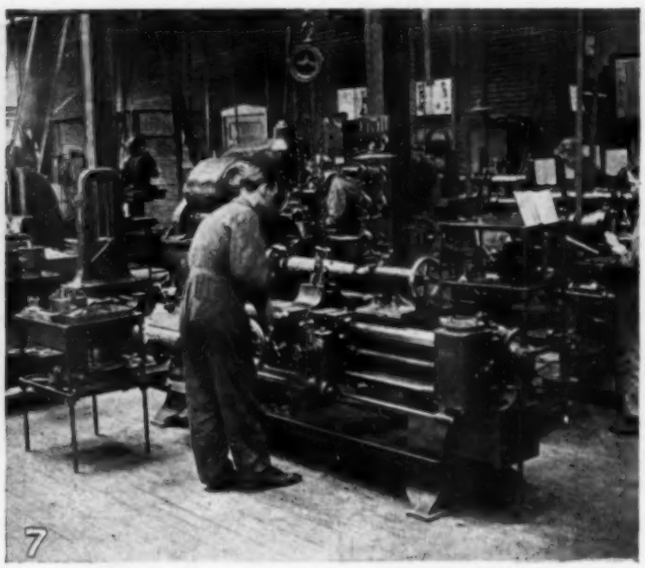
3—Grinding machines and turret lathes

4—Drilling machines and boring mill

5—Planers and punch press







Practical Shop Work

extensive equipment of the University, Lafayette, Ind.

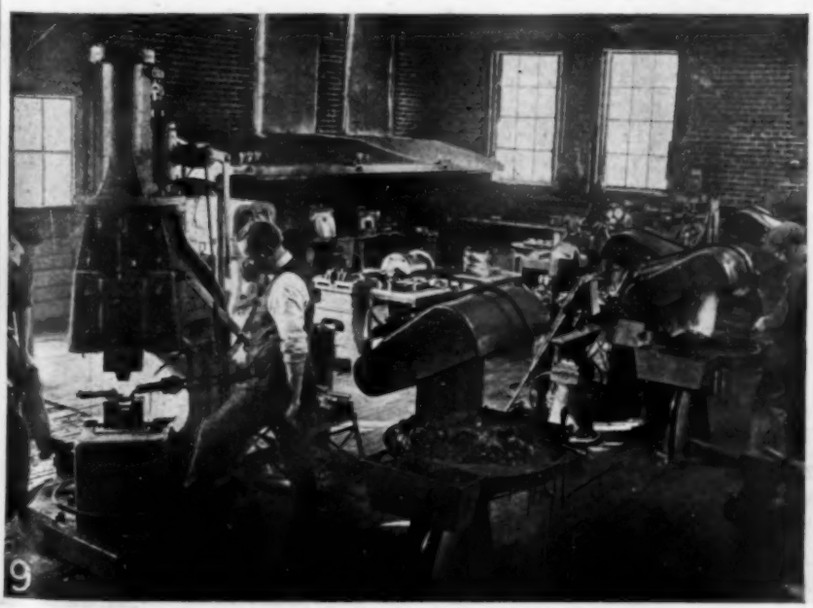
6—Lathes and gas engines built by students

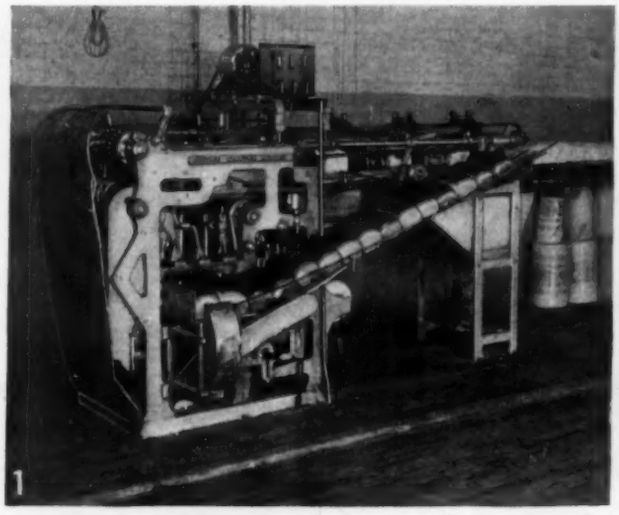
7—Boring machine and heavy lathe

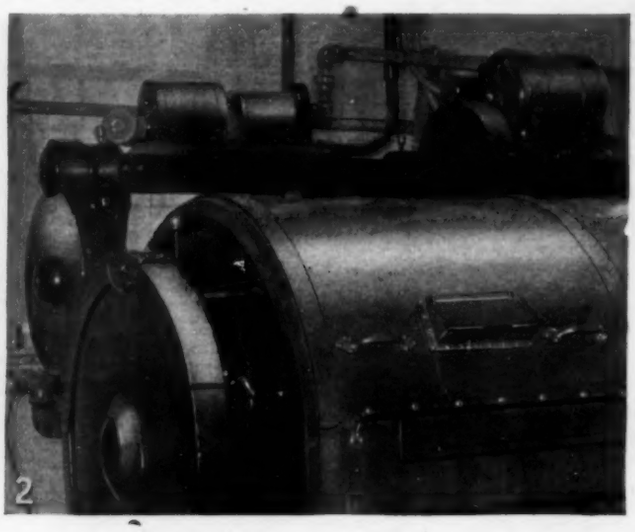
8—Oxyacetylene corner in the forge shops

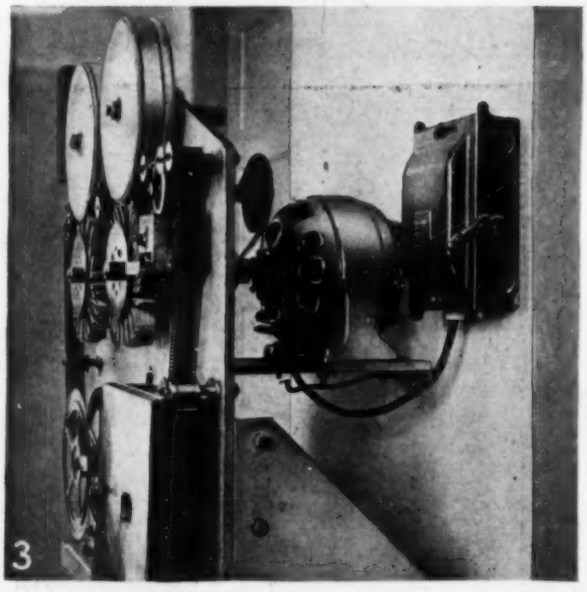
9—Steam-hammer work on crankshaft

10—Another view in the forge shop









Motorized Machines in Many Industries

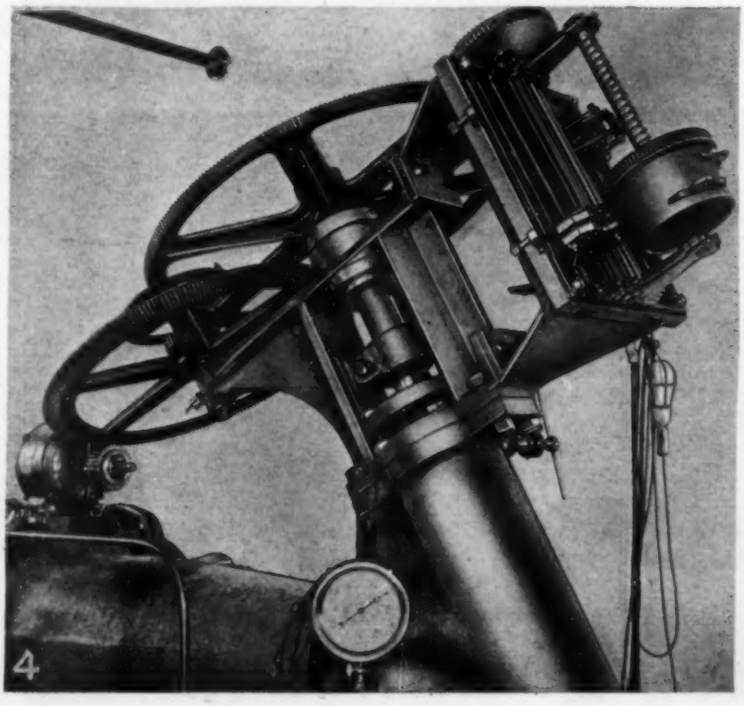
1—Westinghouse motor on bread-wrapping machine

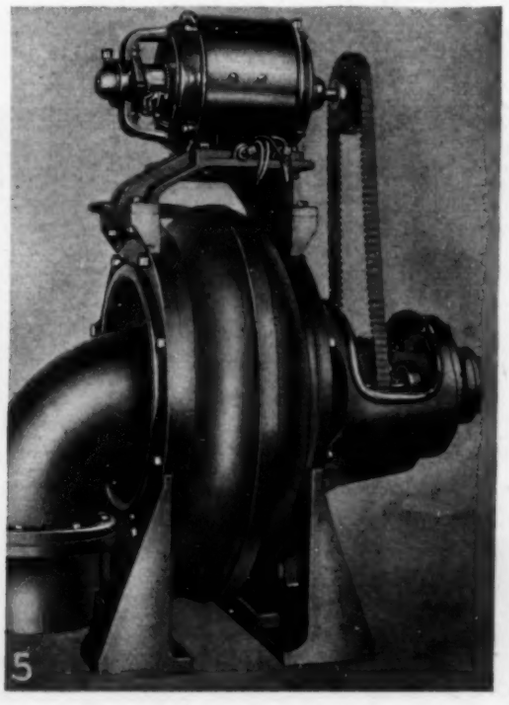
2—Westinghouse motor on laundry machine

3—Fairbanks-Morse ball-bearing motor on film-polishing machine

4—General Electric motor with limit switch for remote control of needle valve of turbine generator

5—Westinghouse motor on centrifugal pump





Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

A Method of Finding Lead Gears—Discussion

By A. L. De Leeuw

THE method described under this heading on page 419, Vol. 63, of the *American Machinist* is interesting but somewhat lengthy and decidedly involved. Besides, no limit of desired accuracy is mentioned so that the reader does not know, even at the end of the article, whether the result obtained meets requirements or not. As it is, the error is 0.000025 in 1.345678, or 25 in 1,345,678, or 1 in 53,827, or one-thousandth of an inch in almost 54 inches.

Any man who has been up against similar problems knows that it is useless to try to get such a degree of accuracy, for the errors in the machine, in the worm wheel (if there is one), in the change gears, and even in the variation in length of machine and work due to temperature variations, are much greater than the limit of error specified.

For practically all work, an error of 1 in 10,000 is permissible, and if this is so then we may just as well ignore the last two decimals and try to find a lead of 1.3456 instead of 1.345678.

But even if we keep the problem as stated, the method of solving it is unnecessarily cumbersome, especially so as there is already a well known method in existence, a method which has been described a number of times in this journal and in various textbooks.

Applying the method, that of continued fractions, to the problem we get the following:

Act as if we want to find the greatest common divisor of 1,000,000 and 1,345,678

```
1000000|1345678(1
       |1000000
        345678|1000000(2
              | 691356
               308644|345678(1
                     |308644
                      37034|
      37034|308644(8
           |296272
            12372|37034(2
                 |24744
                  12290|12372(1
                       |12290
                          82|12290(149
                            |12218
                             72|
```

Here we stop because, if we should work back, as will be shown, we would get a fraction with a very large numerator and denominator, something we do not want. This is due to the last term, 149, being large.

We work back as follows, ignoring this 149:

$$(1)\quad \underset{0}{-}\times\underset{1}{-}\times\underset{1}{\frac{1}{1}}\times\underset{3}{\frac{2}{3}}\times\underset{25}{\frac{8}{25}}\times\underset{28}{\frac{1}{28}}\times\underset{81}{\frac{2}{81}}\times\underset{109}{\frac{1}{109}}$$

so that 81 and 109 are approximating numbers.

If we had also neglected the quotient, 1, before the 149 we would have found

$$(2)\quad \underset{0}{-}\underset{1}{-}\underset{2}{-}\times\underset{2}{\frac{2}{2}}\times\underset{17}{\frac{8}{17}}\times\underset{19}{\frac{1}{19}}\times\underset{55}{\frac{3}{55}}\times\underset{74}{\frac{1}{74}}$$

and if we had neglected still another term (quotient 2) we would have found

$$(3)\quad \underset{0}{-}\underset{1}{-}\underset{8}{-}\times\underset{8}{\frac{8}{8}}\times\underset{9}{\frac{1}{9}}\times\underset{26}{\frac{2}{26}}\times\underset{35}{\frac{1}{35}}$$

This last ratio does not require compound gears. Ratio 2 can be obtained with or without compound gears and ratio 1 does not admit of compounding because 109 is a prime number.

It remains to be seen now if these ratios are sufficiently near to the requirements. The ideal ratio is 1.345678.

Ratio 3, is $35 \div 26 = 1.34615$, giving an error of 48 in 134,567 or 1 in 2,800, which is near enough for some, but not for all purposes.

Ratio 2, is $74 \div 55 = 1.34545$, giving an error of 22 in 134,567 or 1 in 6,116 which is much better than average practice.

Ratio 1, is $109 \div 81 = 1.3456781$, which gives an error of a little more than 1 in 1,345,678.

The description of this method is longer than its execution as will be found upon applying it in practice.

An Unusual Job for a Machine Shop

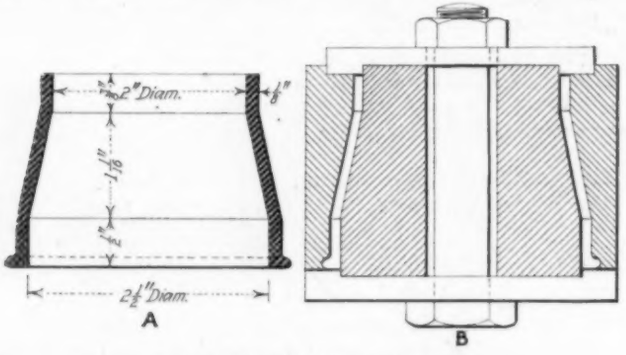
By H. L. Wheeler

Some dust covers were needed to fit over the spindle noses on grinding machines. After experimenting with leather, which proved to be unsatisfactory, it was finally decided to try making them of rubber as shown in the illustration at *A*. The method employed was as follows: A mold, *B* was made of cast iron. Two steel washers, one each at top and bottom, were used to locate the core piece in a concentric position and were held together with a bolt and nut.

The material used consisted of sheet rubber similar to that for making repairs on inner tubes. The rubber was cut into strips about ½ in. wide and wound on the core, which was held on an arbor gripped in a

IDEAS FROM PRACTICAL MEN

bench vise. The rubber was laid on as evenly as possible and trimmed where necessary with a sharp knife. Before the rubber was applied, the core piece and the mold were sprinkled with powdered soapstone. The mold was then assembled and bolted together, then



A molded-rubber dust cover

placed in the furnace and baked for twenty minutes at a temperature of about 400 deg. When removed, it was allowed to cool gradually and without any artificial aids. Cooling with air was tried but was unsatisfactory since it made the rubber porous. When the mold was cool enough to handle, it was taken apart and the rubber cover removed. The work produced by this method was smooth and clean and was in every respect equal to first-class work of a similar nature produced in a regular rubber factory.

Drilling Heads that Hold the Work

BY FRANK C. HUDSON

The two drilling heads shown each combine the drilling mechanism and the holding fixture in one combination. They are both used in connection with brush guards for the vacuum sweepers made by the Hoover company at its plant in North Canton, Ohio. The first head is used to drill the ends for the holding screws and the second, the six holes in the guard for the steel fingers that help to keep threads out of the brush.

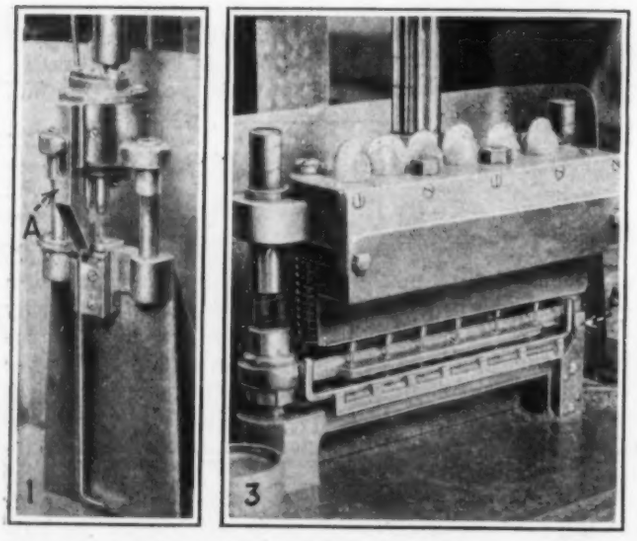


Fig. 1—Combined drilling and holding fixture. Fig. 3—Drilling head with 6 spindles

The first fixture, Fig. 1, combines a double-spindle drilling head with a pillar fixture to guide the drills in alignment with the work. A guard is placed in the opening provided directly below the plate carrying the guide bushings, being held against side movement by the block into which it fits.

As the head descends the arm *A* moves down in front of the bent arm of the guard and holds it against any fore and aft movement during the drilling operation. This method obviates the necessity of clamping the guard by hand, making it necessary only for the operator to put the guards in place and remove them after the drilling head has returned to its upper position. Details of this fixture are shown in Fig. 2 so that modifications can readily be made to suit other work.

The method of holding the work is somewhat different in the second operation, and is shown better in the details in Fig. 4 than in Fig. 3. The guard rests

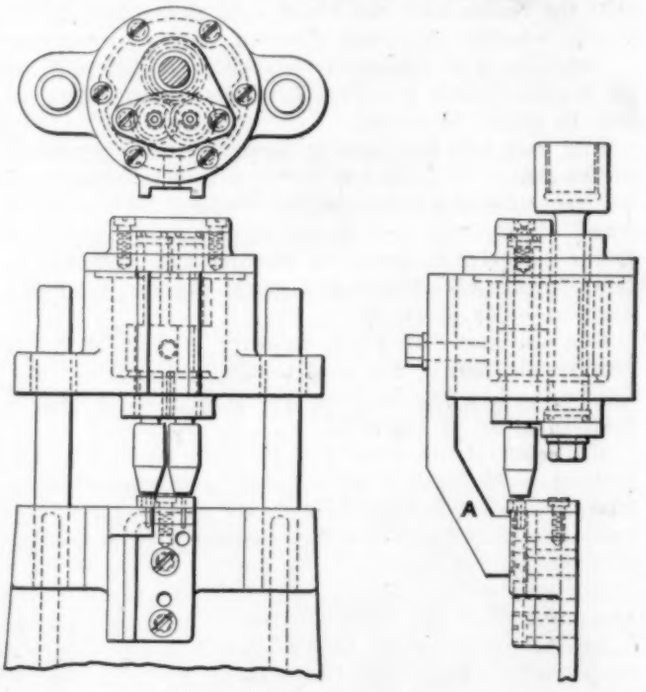


Fig. 2—Details of the fixture

on its back in the lower part of the fixture, or anvil, on which seven raised projections to prevent fore and aft movement are provided. These projections are shown in both views.

The clamping is done by three buttons on the under side of the guide or bushing plate, and not visible in Fig. 3. They are, however, shown at *B*, Fig. 4. The guard is located endwise by the abutment *A*, in both figures.

When the drilling head is in its upper position, the guide plate is raised clear of the work. But after the work is in place and the drilling head is fed down, the buttons *B* seat on the work and hold it firmly in place while the drills are fed through the guard. The coil springs at each end keep pressure on the guide plate while the drills are feeding through it. The pillars at

IDEAS FROM PRACTICAL MEN

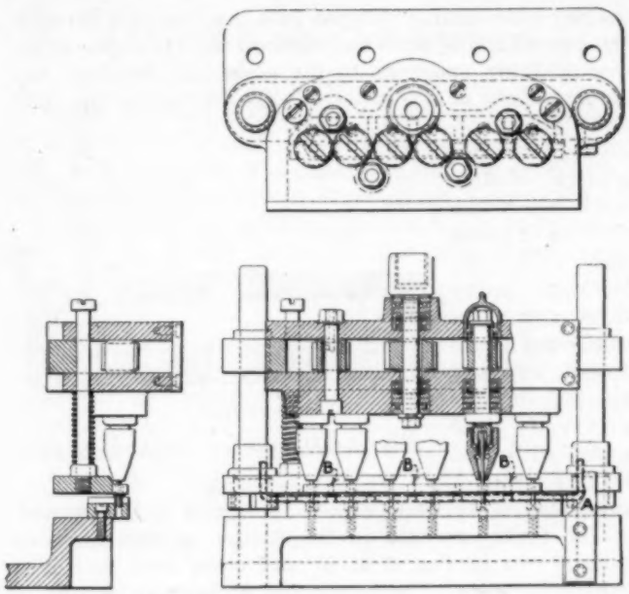


Fig. 4—Details of drill spindles and holding device

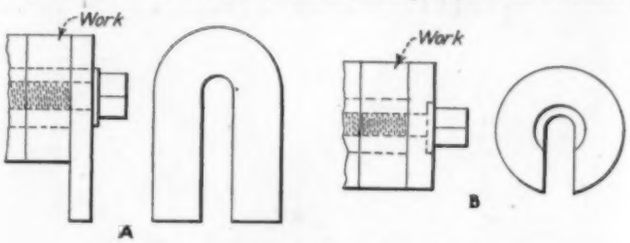
each end guide the drilling head. Fig. 4 shows all details necessary to either construct or redesign the fixture for other work. It will be noted that the upper ends of the spindles are protected by easily-removable caps.

Slotted Washers

By Norman Moore

Theoretically, it is necessary only to back off a screw or nut about half a turn to release a slotted washer, but in most cases a couple of turns are made to allow easy release.

The use of slotted washers is sometimes annoying, because they generally have to be held in position with one hand while the other hand manipulates the wrench.



Two types of slotted washers

Otherwise they would turn with the tightening screw or nut, and drop off when the open end of the slot came uppermost.

I generally use strap washers like the one shown at *A* in the illustration. Since strap washers are heavier at the lower end, they do not turn with the screw or nut. Consequently they do not have to be held in place, to prevent them from dropping off while being tightened.

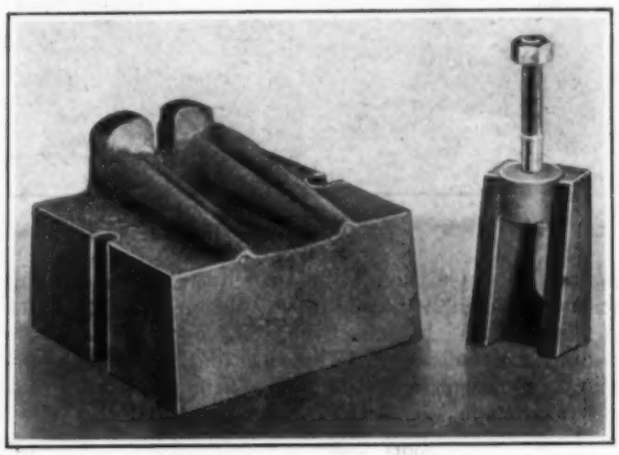
In some operations it is desirable to have the washer concentric and in line with the work. In such cases, a washer counterbored for the collar of the tightening screw, as shown at *B*, will fill the bill.

Adjustable Wedges for Leveling Planers

By W. Edward

In installing a battery of planers in a new building at the plant of the Edward G. Budd Co., Philadelphia, the engineers deemed it advisable to devise adjustable supports by which the planers could be leveled in case of floor settlement.

To this end, adjustable wedge-blocks, one of which is shown in the illustration, were made of cast iron, and



An adjustable wedge block

the planers set upon several of them, the number depending upon the length of the machines.

The lower members, which are approximately 8x8x3 in., have grooves in each side for the holding-down bolts, and the surfaces upon which the wedges bear and slide, are machined. The wedges are machined on the tops and bottoms, and studs are placed in the ends as shown. The angle of the wedges is approximately 15 degrees.

The planers are not anchored to the floor in any way, but are kept from moving by sturdy angle-iron braces set at the ends and sides of the beds. After the wedge blocks were installed, it was a simple matter to compensate for any settling of the floor, and to keep the planers level.

Single-Hole Production Drilling

By W. F. Sandmann

Although the multiple drilling machine is still thought of by some manufacturers as being designed only for drilling parts having a large number of holes in the same plane, several production plants are using it to supplant batteries of single-spindle drill presses on jobs having but one hole to drill, and they are finding it the ideal machine for their purpose.

The builders of a certain line of multiple drilling machinery are often called on to adapt their machines to single-hole jobs. What they really do is to adapt the jobs to the machines by the use of suitable jigs and fixtures. Practically no other type of equipment offers the possibilities for advanced jig and fixture design as does the multiple drilling machine.

IDEAS FROM PRACTICAL MEN

The Chevrolet shifter fork shown in Fig. 1, furnishes an illustration of what is being done in single-hole, production drilling. This part is a heavy, tough forging and considerable power is required to force a ¾-in. drill through the blank.

In Fig. 2 is shown the set-up that was finally worked out on a straight-line type, multiple drill, equipped with a rotating table. The fixture is built to accommodate

Fig. 1—Chevrolet shifter fork

twelve forks at a time, six of which are in the drilling position under the head of the machine, and six are at the front of the table where the operator does the loading and unloading. The machine is in continuous operation except for a few seconds required for indexing the table.

The guide bushings are in the bushing plate *A* which is suspended from the head of the machine by two

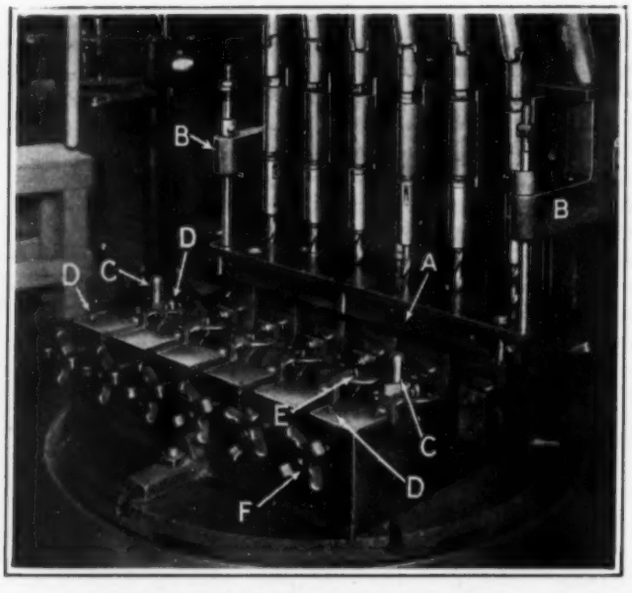


Fig. 2—Multiple drilling machine

brackets *B*. When the head of the machine descends, the bushing plate locates on the fixture over the two pins *C* and rests on the hardened pins *D*. Further downward movement of the head causes the brackets to slide down over the suspension rods.

The suspension plate is of the reservoir type and is provided with a cover. The sketch, Fig. 3, gives an idea of its construction. The ribbed, cast-iron plate *A* carries the drill bushings and the cover plate *B* is screwed to it. At *C* is shown one of the splash guards around the drills, secured to the cover by screws. The cutting compound is pumped into the reservoir through the pipe at *D* and flows out through the bushings, which are the only openings in the plate. A constant and ample supply of compound always surrounds the drill and flows directly to the point of the work where the drilling is being done. The objectional spray thrown up when compound is directed against an open drill, is entirely done away with and every drop of compound serves the purpose for which it is intended.

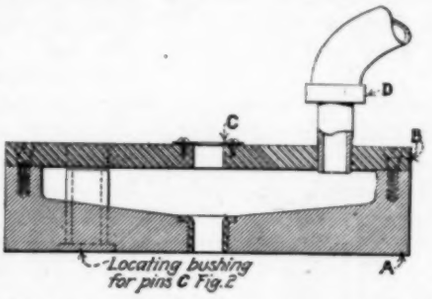


Fig. 3—Details of suspension plate

The forks are held in the fixture against the stop pins shown in Fig. 2 at *E*, and other stop pins that cannot be seen. The handknobs *F* force in a type of V-clamp which securely locks the pieces in place. It is necessary only to back the knob a half turn to release the work.

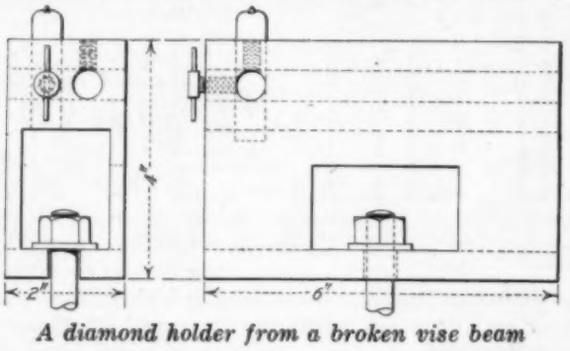
The fixture is constructed on the base-plate principle with each holding fixture a separate unit, screwed and doweled to the base plate.

A Handy Diamond Holder from a Piece of Scrap

BY W. G. AULMANN

Some time ago I made the diamond holder shown in the accompanying sketch from the broken beam of a bench vise, and I have yet to see any tool of this nature that is more handy for general use.

As the diamond can be set in three ways it can be used under the wheel at various heights; thus saving a lot of time and labor in cranking the wheel-head up or



A diamond holder from a broken vise beam

down whenever dressing is necessary. Also the diamond can be used on the side to dress saucer wheels to grind snap gages and similar work.

By cutting the hole through the block I am enabled to bolt it down very handily when the magnetic chuck does not happen to be on the machine. I have also found it very handy on the shaper or planer. By setting the device on parallels at the required angle it can be made to produce any angle of face desired on the wheel.

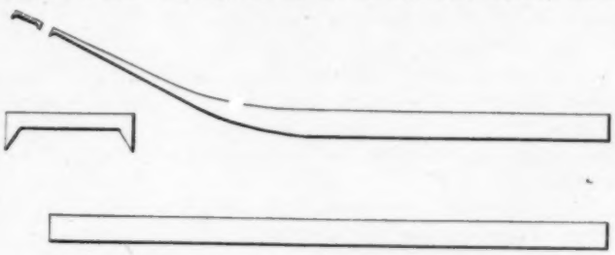
IDEAS FROM PRACTICAL MEN

A Handy Scriber for Keyways

BY ALEX. G. MACKENZIE

Where cams or gears that are already keyseated, have to be mounted on shafts in certain relative positions to other parts, it is sometimes difficult to transfer the marking for the keyways from them to the shafts.

In such cases, the scriber illustrated is a very handy tool. It can readily be made of square, drawn steel



Scriber for transferring keyways

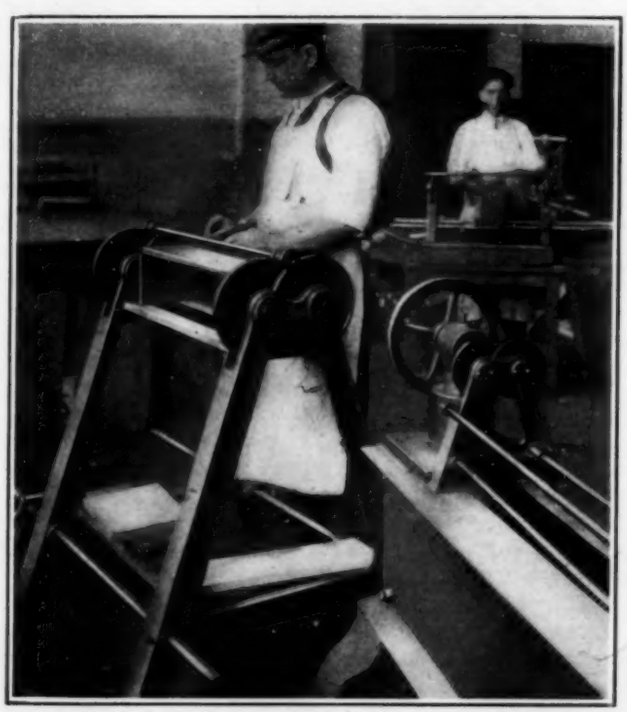
of the same size as the keyway to be marked. It should be bent and thinned down at one end, as shown, leaving a head for the cutting edges.

In use, the scriber is entered into the keyseat of the cam or gear, with the cutting edges resting on the shaft to be marked. By moving the scriber along the shaft, exerting slight pressure, the keyway to be cut will be marked by two clean, sharp lines.

Using Balancing Ways for Truing

BY CHARLES T. HENRY

It is very necessary that the ink rollers on printing presses run true in order to obtain uniform inking of the forms. So as to insure concentricity, the roller shafts are carefully trued before casting the roller composition on them.



Using balancing ways for truing shafts

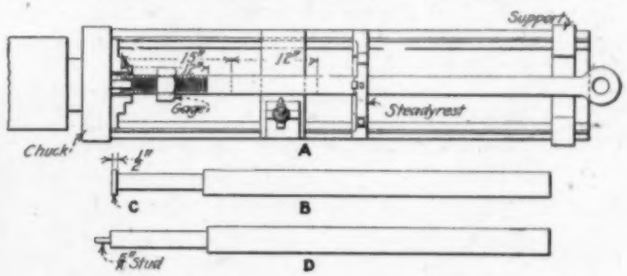
Instead of truing between centers, however, the Kelly Press Division of the American Type Founders Co., Elizabeth, N. J., utilizes the roller balancing ways made by the Rockford Tool Co., as shown in the illustration. The distance between the legs, is adjusted so that the guide rollers rest on the rolls of the machine. The operator then spins the shaft and notes the high spots, marking them the same as when truing between centers. This method is not only more rapid than putting the roller between centers but the shaft is trued with the guide rollers on which it runs, insuring the roller running better in the press. The wooden frame under the shaft, resting on the bed of the machine, makes it easy for the operator to mark the high spots on the shaft.

Turning and Threading Long Work

BY O. A. KING

Recently, there came to our shop a number of tie rods that were to have 15 in. cut from the threaded ends, and to have new threads cut for a distance of 12 in. The rods were 2½ in. in diameter, 12 ft. long, and had eyes formed at the ends opposite the threaded parts.

It was impossible for us to swing the rods in a lathe, since the longest lathe in the shop had a bed only 12 ft. in length. However, we managed to do the work in the manner shown in the sketch. The tailstock was removed and the steadyrest jaws adjusted to a 2½-in. gage. The rods were then chucked by the threaded ends and supported by the steadyrest as shown at *A*. An outboard bearing on blocks, supported the outer



Method of machining long work

ends of the rods, so as to take some of the weight from the steadyrest. Before chucking, a nut was screwed on the threaded parts to act as a gage for the new threads to be cut. The present threads were continued to a point 27 in. from the ends. The rods were then removed and cut to the desired length on a power hacksaw.

Similar work, as at *B*, can be turned by this method. Here the part *C* that was held in the chuck, can be cut off after the turning has been done, providing that ½ in. can be spared from the length of the shaft.

Where work cannot be shortened, a stud for a dog can be screwed into one end as shown at *D*. The tap hole can be drilled by a portable drill, and the tapping done by hand. While the stud does not have to be in the exact center of the shaft, it must be screwed in tight enough to prevent turning while the cut is being taken.

Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Closing Pin Holes in Brass Castings

Q. We noted an item on page 484, Vol. 63 of the "American Machinist" pertaining to a method of closing pin-hole leaks in small castings. We wish to know how you would have answered the question had the castings been of brass instead of cast iron.

A. Due to the rust-resisting qualities of brass it is not possible to close pin holes by rusting them shut but we believe it would be worth your while to investigate the possibilities of impregnating the castings with some liquid material that could be handled to advantage and that would set after it was in place.

We know of an instance when this was done to steel castings, that were to hold oil, by pouring in shellac to flood the inner surface and by then applying air pressure to force the liquid into the porous grain of the metal.

It occurs to us that you might successfully use water-glass or bakelite varnish rather than shellac. You could design a quick-acting fixture to plug all of the openings but one, and another to insert in the last opening through which air could be admitted under pressure.

The pressure could be applied and then shut off, the fixtures removed and the excess liquid poured out. While it was still in the liquid form, that which adhered to the castings could be dissolved off. After the material in the pin holes had set, an action that could be hastened by applying heat, it should be as serviceable as a sound casting for all ordinary purposes.

Trouble with a Forge Shop Blower

Q. We have two centrifugal blowers in our forge shop delivering air into a common header, and we find we are not getting enough volume, even though the blowers are rated at 1 lb., 3 oz. pressure. The piping extends to the hammers to use the air for blowing scale from the dies and to the furnaces where the air is released in front of the doors to act as a shield. Please advise us the solution for our trouble.

A. It is not possible to give you a certain solution without having a layout of your complete blower system, with sizes and speeds of the blowers, inlet and outlet areas, and other data, but we can give you a general hint or two that may be of assistance.

Fundamentally, a centrifugal blower is designed to move a quantity of air at a given velocity, the pressure generated being a factor dependent on this velocity.

The quantity of air that the machine will move is dependent on the inlet area and the outlet area, and any restrictions to flow in either.

Within its capacity range, the act of cutting down areas on either side or of placing restrictions to flow in the line will have the effect of reducing the volume of air, taken in and delivered without materially increasing the pressure. Increasing areas beyond those proper for the given blower will reduce velocities and pressures as a result of the velocity reduction.

The centrifugal blower of the type you probably have is not essentially a pressure-building machine, and as restriction is offered to flow, the machine figuratively "lays down." You cannot get more air at one point by checking delivery at another within the delivery range.

On this basis, the area of the common header, beginning where the two delivery lines join, should be equal, roughly, to the sum of the two delivery areas.

At each take-off the area should reduce by the amount of the take-off.

Right-angle bends, sharp curves, very long runs and obstructed inlets should be avoided.

When all these things are correct and when the sum of the outlet areas is equal to the sum of the delivery areas at the blowers, you will be getting the maximum you can expect from your system.

In this connection, the manufacturers of blower equipment, for the most part, maintain expert service-engineering departments that will be glad to assist you in your problem.

Wanted—a Wire Measuring Machine

Q. We are in the market for a testing machine for testing wire of sizes from 14 to 16 gage. The test pertains to the cross-section of the wire which we desire to check on two diameters, or to approach an area measurement. We want to run lengths of special wire, varying from 5 to 10 ft., through the machine and have accurately indicated to us the variations from round, as well as from diameter measurements. We know of a machine that will give the diameter check one way, but if the wire happens to be slightly oval or if there is an imperfection on the surface, the single reading will not disclose the fact. Please let us have your advice.

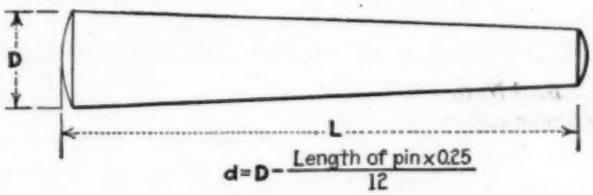
A. We are publishing your question to give any manufacturer who may make such a machine the opportunity to quote you through the *American Machinist*.

We are of the opinion, unless there is such a machine on the market, that the best course for you to follow will be to yourself design and build, or contract for, the necessary fixtures which you can adapt to the mounting of standard micrometer-dial gages that can be set to give you readings in the direction you desire.

The manufacturers of these gages have had questions similar to yours put to them many times in the past, and they have a wealth of information concerning gage application that you can use to advantage and can have for the asking.

We suggest that you get in touch with them and state your problem just as you have presented it to us.

Table of Drill Sizes for Taper Pins



This table gives the drill sizes for taper pins ranging from No. 0, ¾ in. long to No. 10, 6 in. long.

No. Pin	L	D	d	No. of Drill	No. Pin	L	D	d	No. of Drill
0	¾	0.156	0.1404	28	8	1¼	0.492	0.466	15/32
0	1	0.156	0.1352	29	8	1½	0.492	0.4608	15/32
1	¾	0.172	0.1564	22	8	1¾	0.492	0.4555	29/64
1	1	0.172	0.1512	24	8	2	0.492	0.4503	29/64
1	1¼	0.172	0.146	26	8	2¼	0.492	0.4451	29/64
2	¾	0.193	0.1774	16	8	2½	0.492	0.4399	7/16
2	1	0.193	0.1722	17	8	2¾	0.492	0.4347	7/16
2	1¼	0.193	0.167	18	8	3	0.492	0.4295	7/16
2	1½	0.193	0.1618	20	8	3¼	0.492	0.4243	27/64
3	¾	0.219	0.2034	6	8	3½	0.492	0.4191	27/64
3	1	0.219	0.1982	8	8	3¾	0.492	0.4139	27/64
3	1¼	0.219	0.193	10	8	4	0.492	0.4087	13/32
3	1½	0.219	0.1878	12	8	4¼	0.492	0.4035	13/32
3	1¾	0.219	0.1825	14	8	4½	0.492	0.3982	13/32
4	¾	0.250	0.2344	15/64	9	1½	0.591	0.5597	9/16
4	1	0.250	0.2292	15/64	9	1¾	0.591	0.5545	37/64
4	1¼	0.250	0.224	1	9	2	0.591	0.5493	37/64
4	1½	0.250	0.2187	2	9	2¼	0.591	0.5441	37/64
4	1¾	0.250	0.2135	3	9	2½	0.591	0.5389	37/64
4	2	0.250	0.2083	4	9	2¾	0.591	0.5337	17/32
5	¾	0.289	0.2734	11/64	9	3	0.591	0.5285	17/32
5	1	0.289	0.2682	11/64	9	3¼	0.591	0.5233	17/32
5	1¼	0.289	0.263	11/64	9	3½	0.591	0.5181	33/64
5	1½	0.289	0.2577	1/4	9	3¾	0.591	0.5129	33/64
5	1¾	0.289	0.2525	1/4	9	4	0.591	0.5077	33/64
5	2	0.289	0.2473	1/4	9	4¼	0.591	0.5025	1/2
5	2¼	0.289	0.2421	11/64	9	4½	0.591	0.4972	1/2
6	¾	0.341	0.3254	21/64	9	4¾	0.591	0.4929	1/2
6	1	0.341	0.3201	21/64	9	5	0.591	0.4868	31/64
6	1¼	0.341	0.315	5/16	9	5¼	0.591	0.4816	31/64
6	1½	0.341	0.310	5/16	9	5½	0.591	0.4764	31/64
6	1¾	0.341	0.3045	21/64	10	1½	0.706	0.6747	43/64
6	2	0.341	0.2994	21/64	10	1¾	0.706	0.6695	43/64
6	2¼	0.341	0.2941	21/64	10	2	0.706	0.6643	43/64
6	2½	0.341	0.2889	9/32	10	2¼	0.706	0.6591	43/64
6	2¾	0.341	0.2837	9/32	10	2½	0.706	0.6539	43/64
6	3	0.341	0.2785	9/32	10	2¾	0.706	0.6487	43/64
6	3¼	0.341	0.2733	11/64	10	3	0.706	0.6435	43/64
7	1	0.409	0.3881	25/64	10	3¼	0.706	0.6383	43/64
7	1¼	0.409	0.3829	25/64	10	3½	0.706	0.6331	43/64
7	1½	0.409	0.3777	3/8	10	3¾	0.706	0.6278	5/8
7	1¾	0.409	0.3725	3/8	10	4	0.706	0.6226	5/8
7	2	0.409	0.3673	3/8	10	4¼	0.706	0.6174	5/8
7	2¼	0.409	0.3621	23/64	10	4½	0.706	0.6122	41/64
7	2½	0.409	0.3569	23/64	10	4¾	0.706	0.6078	41/64
7	2¾	0.409	0.3517	23/64	10	5	0.706	0.6018	41/64
7	3	0.409	0.3465	11/32	10	5¼	0.706	0.5966	19/32
7	3¼	0.409	0.3413	11/32	10	5½	0.706	0.5914	19/32
7	3½	0.409	0.3361	11/32	10	5¾	0.706	0.5862	19/32
7	3¾	0.409	0.3309	11/32	10	6	0.706	0.581	37/64

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Trim Line

Technical Abstracts

Observing Mechanisms

The use of apparatus that causes rapidly moving parts to appear stationary at any point in the cycle of movements is discussed by Peter Davey. The modern tendency in the design of machinery of all kinds is increase of speed, necessitating a much fuller knowledge of the behavior of machinery under working conditions than was the case when lower speeds prevailed. Almost any engineer can think of a number of cases in which the increase of speed has led to trouble and that the trouble could be located by some simple means and much time and expense could be saved in adjusting the operation to the new conditions of working.

Various means have been used for the motion study of high-speed mechanisms, the most familiar form being the ultra-rapid or slow-motion moving picture. This device, however, has its limits, the camera must be handled by a skilled operator and special lighting is required to produce good results. The film is very expensive and, further, the ordinary type of portable moving picture camera is not rapid enough for many of the jobs to which it has been applied, although special types have been evolved that are many times more rapid.

The alternative to the moving picture is the stroboscopic principle. This principle dates back many years and is well known in scientific fields, but there have been few commercial applications of it, probably due to the fact that there have been a number of practical difficulties in the way of producing a really good stroboscope. The stroboscopic effect is obtained by interrupting the vision between the observer's eye and the mechanism in such a way that he gets a quick glimpse of the mechanism each time it reaches a certain point in the cycle of operations. The result of this quick succession of glimpses at the same point every time, is that the mechanism will appear absolutely stationary at that point. One use of the device, for example, deals with the lubrication of a pair of helical gears, which to the vision appeared running surrounded with a mist of oil. Under the stroboscope, however, it was seen that the oil was merely hitting on the top of a tooth every time, rolling across the tooth and then flung off before it had a good chance to get down into the mesh, hence the gears were running practically dry and noisy.—*Machinery*, Sept. 1925, p. 19.

Labor Turnover

Harold Fischer has made a research into the cost of labor turnover in some industries. He finds that in the shoe industry it costs $239 to hire and train inexperienced workers. Semi-skilled workers with previous experience in other shoe factories but no knowledge of the jobs to which they are assigned cost $190 to hire and train, whereas operators skilled in operations for which they have been hired cost only $24, as do employees who have rehired.

Investigations in a large rubber company showed that the cost of hiring and training operators in the tire department was $50 per operator and that the average training period was four weeks.

Mr. Fischer gives an estimate that in order to maintain a working force of 40,000,000 in the United States it is estimated that 50,000,000 workers are hired annually; in other words, there is a turn over of 125 per cent.—*Industrial Management*, Sept., 1925, p. 150.

Die-Castings Made of Non-Ferrous Metals

Beginning with a short historical review of die-casting, Marc Stern explains the production of die-castings in metallic or non-metallic long-life molds and in combination with destructible cores. They may be made by filling the mold by gravity or centrifugal force, or by filling the mold by gravity and, after the outer skin has become chilled, pouring out the excess metal. These castings are known respectively as permanent-mold, centrifugal and slush castings. On the other hand, a die-casting may be defined as a casting formed in a metallic mold or die from metal subjected to mechanical or gaseous pressure while in the molten state.

In die-castings, the metal being liquid, the pressure is practically uniform in all directions and complicated coring of holes and of side cavities is therefore easy of accomplishment. The molten metal, coming into contact with the comparatively cold surfaces of the mold chills immediately and the feed of the metal is maintained under full pressure until the die-casting has solidified completely. The sudden cooling forms a smooth, hard skin on the surface with a comparatively coarse structure at the center of the walls.

Alloys with low fusing-points, best adapted to the die-casting process, are divided into groups and their characteristics are stated. The design of die-castings is covered and the author treats also of polishing, enameling and electroplating, explaining the methods used and the application and limitations of die-casting in general.—*Journal of the S.A.E.* Sept. 1925, p. 254.

Salt Baths

A mixture of 55 per cent of sodium nitrate and 45 per cent of sodium nitrite when heated will melt at 430 deg. F. and will give a usable range of 430 deg. to 900 deg. F. Similarly a mixture of 28 per cent of sodium chloride and 72 per cent of calcium chloride will melt at 940 deg. and will take a range of heat from 1,000 deg. to 1,600 deg. F. which is its top limit.

Lead baths are extensively used for temperatures up to 1,200 deg. F. at which lead begins to vaporize.

Liquid heating baths are used for the sole purpose of maintaining an absolutely clean surface on the material during the heating process. For equal exposure to heating from all sides, tools to be heated are usually suspended in the bath of molten liquid. Pieces with sharp corners, or with varying sections should be pre-heated before being put into the liquid bath.—*Fuels and Furnaces*, Sept. 1925, p. 948.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

A Code of Ethics for Buyers

THE National Machine Tool Builders Association has adopted a code of ethics to be followed by its members in selling their product. Those who have studied this code consider it a step in the right direction.

But as there are two parties to every deal the job is only half done unless both sides adhere to a similar standard of ethics. At the present time it too often seems that all the ethics were on the part of the seller and the buyer had not learned the meaning of the word.

One instance will suffice at this time. A builder who had supplied a large user with a machine suggested a special fixture by which the work could be handled in less time. The user was interested and asked the builder to put the idea on paper. The fixture was designed and submitted but no order resulted.

Inquiry revealed that the user had sent the design to a job shop and had had a number of fixtures built without even mentioning it to the designer, much less giving him a chance to bid on the fixtures. This appropriating of ideas is all too common in many lines, and the machine builder is a heavy loser in this practice. How anyone can justify the appropriating of a design as in this case, with no recompense to the designer, is difficult to understand.

The industry needs a Code of Ethics for Machine Buyers, just as much as for machine builders—perhaps more.

Adequate Sources of Supply Are the Best Forms of Preparedness

ONE of the lessons learned in the World War was the necessity for establishing a source of supply for the materials needed. Carrying out this idea the Ordnance Division of the War Department is cultivating the good will of manufacturers who can supply war material by encouraging them to develop facilities for producing it should it be required. This is not being done by letting fat contracts but by establishing cordial relations based on the assurance of fair and considerate treatment.

If such a policy is desirable to insure a supply of ordnance material, it is an absolute necessity in connection with aircraft. As yet, however, those in charge of aircraft in both army and navy do not seem to have realized the wisdom or necessity of such a policy. Instead, they seem to devise ways and means for discouraging those who are trying to build up sources of supply for aircraft needs.

Instead of considering the reliability of sources of supply and awarding contracts to those who have proven worthy in the past, they encourage concerns with no experience by awarding contracts at prices that have spelled ruin to several such bidders. In some cases this shortsighted policy has been pursued a second time on the same material, delaying its production by months if not years.

In the meantime the few concerns whose faith in the future of aviation has carried them through the lean years of any new industry, are deprived of orders that rightfully belong to them. Economy is to be commended. But it can hardly be called economy to award contracts to firms without experience when this bids fair to cripple the reliable sources of supply.

A World of Wonders

THE McMillan polar expedition has brought to light new geographical wonders and at the same time has put modern mechanical devices to even more marvelous uses. So little attention seems to have been paid to the latter achievement that it seems wise to point out its importance.

Imagine, if you can, the sensation that would have been created twenty years ago if Peary had been able to report each afternoon by radio his discoveries of the morning. Any one foolish enough to predict such an occurrence in 1905 would have been laughed to scorn, and yet here we have just that miracle and we think little of it.

Take also the contribution of the airplane to geographic knowledge of the polar region. The pilots attached to the McMillan expedition flew some thousands of miles and discovered a high mountain range and a large frozen lake hitherto unknown. To reach the same locations by ordinary means would have taken months or even years of struggle and hardship. It seems likely that if the forbidding regions that surround the earth's spindle ends are ever mapped it will be by airplane camera.

The head of the expedition, now well on its way home, is reported as being convinced that airplanes are not practical for extended polar flying. He should be well satisfied with the achievements on this trip and look forward to better things as better airplanes are developed.

And back of these mechanical wonders lies the machine tool equipment without which their achievement would have been impossible. The designers and builders of machine tools can honestly point with pride to their part in the great deeds of the polar explorers.

Shop Equipment News

Bilton "Pro-Ducto-Matic" Milling Machines

The Bilton Machine Tool Co. of Bridgeport, Conn., has brought out two adaptations of its "Pro-Ducto-Matic" milling machines for milling clevis yokes, valve tappets, small motor shafts and many other small pieces requiring operations that may be performed in one movement of a gang of milling cutters.

In Fig. 1 is shown the machine with its indexing turret mounted upon a horizontal axis with the fixtures attached to the periphery of the dial. The machine is here shown set up to mill the small clevis yokes that may be seen in the fixtures. The cycle of the machine is automatic, clamping, milling and ejecting two pieces at each cycle. The operator has only to place the pieces in the fixtures as the latter reach the loading station.

The vertical movement of the cutter-head as employed in the older type of machine has been discarded, and the entire machine is made much heavier than formerly. The cutter head is now bolted to the slotted face of the ram and is provided with a vertical screw adjustment to center the cutters.

The journals of the cutter spindle are 3 in. in diameter and the spindle is supported in three bronze bearings, the middle one of which is 9 in. long. An outboard bearing beyond the cutters prevents the spindle from springing under the pressure of the cut, and a similar bearing outside the driving gear performs a like service for the other end.

The machines are driven by independent electric motors suspended below the bed. Power is transmitted through silent chains and gear drives to the cutter spindle and to the primary camshaft from which the cycle movements are derived. Change gears in both trains provide means to adapt the speed of cutters and rate of feed to the work in hand.

The second machine, shown in Fig. 2, has practically the same movements except that the turret rotates about a vertical axis and the holding fixtures are bolted to the upper face instead of to the periphery. In this machine the work is clamped by the movement of a lever, manipulated by the operator as he loads each piece into its respective fixture.

All of the cycle movements of both machines are derived from the camshaft at the end of the bed. The cams may be changed to suit the stroke and the rate of feed to the work. The maximum stroke that may be obtained from the ram is 6 in. The cutters may be centered with the work through a distance of 4 in. by means of a vertical adjustment and the diameter of the cutters used may be within a range of 9 inches.

These models in the series of Pro-Ducto-Matic milling machines require a floor space of 48x60 in. and their weight averages 3,000 pounds.

"Farrell's-85" Steel in Conveyor Chains

The Stephens-Adamson Manufacturing Co., Aurora, Ill., has acquired the rights to make use of the special steel known as Farrell's-85 in the conveying and materials-handling equipment that it builds. It is being supplied in several types of chain at present, combination, lay-bushed and 1130-class roller chain, among others, in forms that include the usual attachments for carrying elevator buckets and conveyor flights.

The "Farrell's-85" steel is cast. It is said to show a high tensile strength and to offer a marked resistance to wear and abrasion.

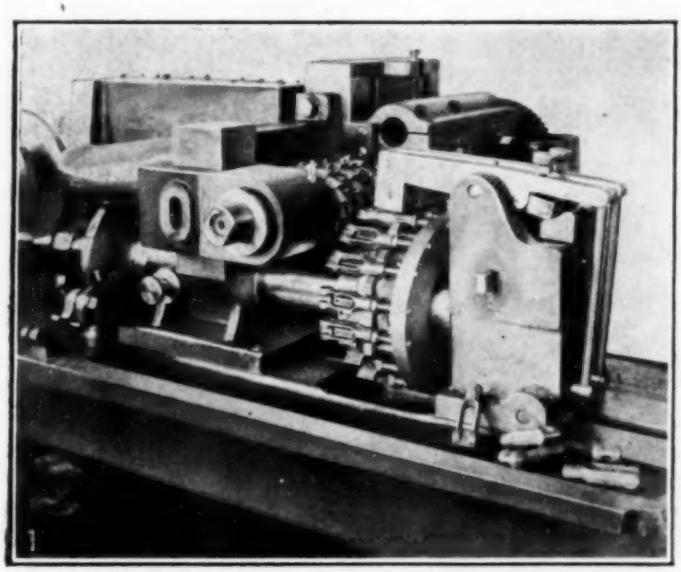


Fig. 1—Bilton No. 2 Pro-Ducto-Matic milling machine.

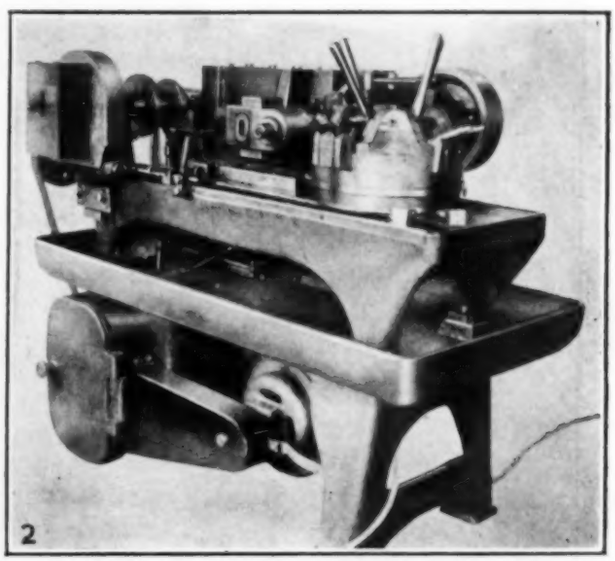


Fig. 2—Bilton No. 3 Pro-Ducto-Matic milling machine

SHOP EQUIPMENT NEWS

Cincinnati All-Steel Press Brake, Series 70

The Cincinnati Shaper Co., Cincinnati, Ohio, has marketed an all-steel press brake somewhat smaller than former models heretofore manufactured that range upward to a capacity of ½-in. sheet steel. The machine is designated series 70 and used for bending, forming, flanging or punching sheet metal, such as metal office equipment, steel lockers, shelving, building trim, stairs and automobile and truck bodies.

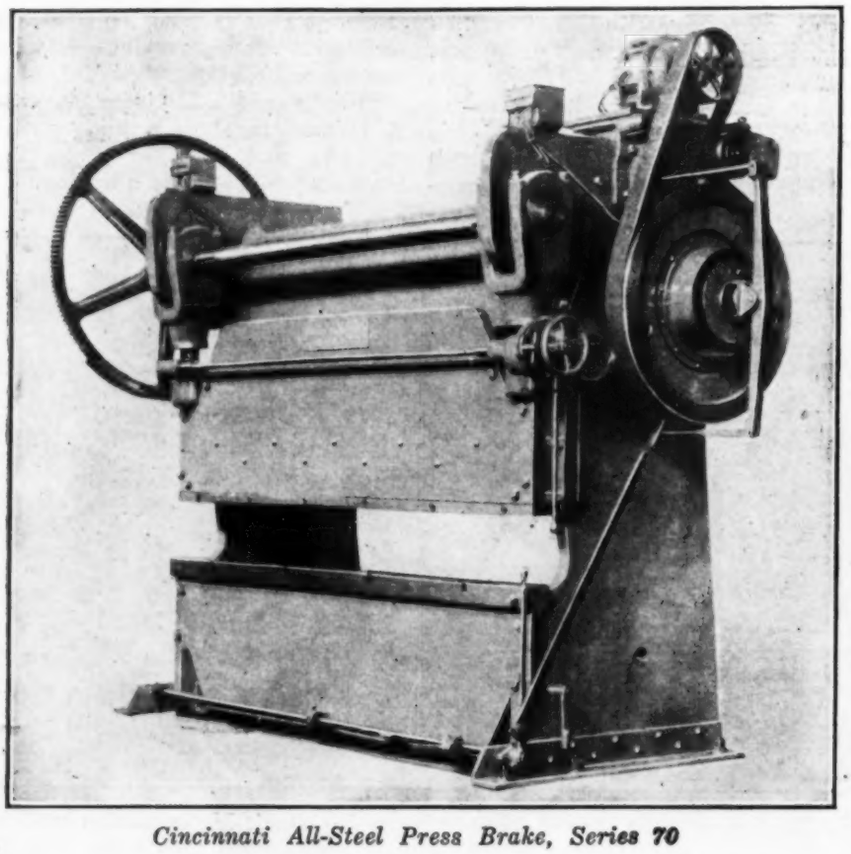
The two upright housings of the machine are cut from 3-in. solid steel plate, finished to 2¾ in. in width. The ram and the bed of the machine also are cut from similar plate, having heavy angles welded on for additional stiffness. The top of the bed is made from a steel billet machined in the shape of a saddle and solidly welded to the main frame.

All gears, including the large one, are made of steel. Double keys of the Kennedy type are used throughout. The screws, cut from carbon-nickel steel, are provided with a buttress thread to eliminate the bursting effect on the connecting rods. The worm and wormwheel adjustment to the screw is 5 in., being operated either by hand or power. Quick bearings for the ram are gibbed in both directions and provide for the thrust encountered in punching. The clutch is of the multiple-disk type, using special asbestos material on the friction surfaces. The flywheel is mounted on ball bearings, as well as the idler pulley for the motor drive and the worm adjustment to the ram. All shaft bearings are bronze bushed. The worm and wormwheel adjustment and its power elevating device all run in oil, while other units are automatically oiled from the two oiling stations on top of the housings.

The control of the machine is either by treadle or hand lever, both of which can be moved to any position across the front of the machine. An efficient brake is provided for stopping the machine immediately upon release of the clutch.

The machine has a 3 in. stroke, 5 in. adjustment and a throat clearance from the center of the dies of 8 in. It operates at 30 strokes per minute. It can be furnished in any length from 4 ft. 6 in. to 10 ft. 6 in. between housings. The machine has a capacity for making right-angle bends continuously or at one stroke, in 10-gage steel 10 ft. long, over 1¼ in. die to a radius equal to the thickness of the metal. It is provided for either belt or motor drive. The machines are shipped assembled on skids to simplify erection.

The advantages claimed for the machines are that their construction overcomes troubles from breakdowns, eliminates the question of deflection in securing perfect bends and removes any limitations on the width of material that can be handled by means of an open throat.

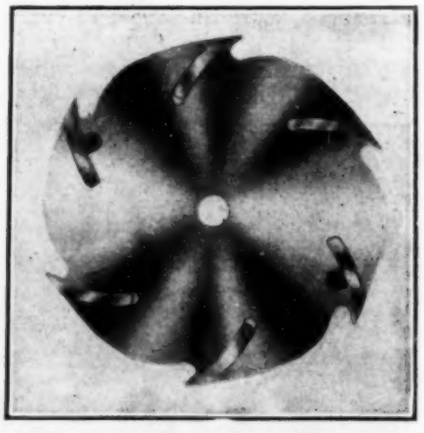


Cincinnati All-Steel Press Brake, Series 70

Disston Inserted-Tooth Saw and Groover

The "Ideal" saw and groover, manufactured by Henry Disston & Sons, Inc., Philadelphia, Pa., using the inserted-tooth principle, is designed for use in grooving, molding, heading and tenoning.

The teeth, of special high-speed steel are set in the body or blade to provide clearance without swaging or setting. As may be seen in the illustration, the teeth have a rack cut along one side. They are inserted into sockets arranged spirally, so that the rack will engage with a special lock in the side of the socket. Wear on the teeth is compensated for by moving the teeth ⅛ or ¼ in. outward.



Disston Inserted-Tooth Saw and Groover

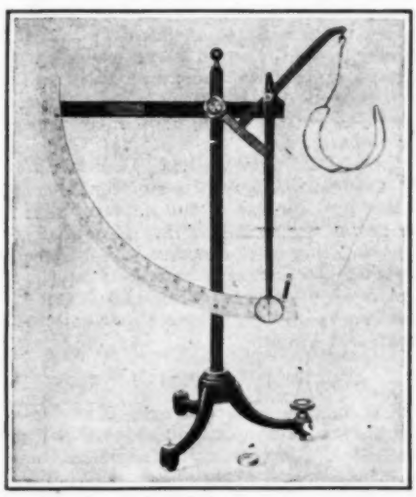
New teeth or teeth of a different

SHOP EQUIPMENT NEWS

pattern may be inserted without removing the saw from the arbor. They may be had with any form of cutting edge, so that special saws may be built up to meet the requirements of the work in hand and then changed at will.

Amthor Direct-Reading Quadrant-Type Scales

A direct-reading, quadrant-type scale is being made in two sizes by the Amthor Testing Instrument Co., 309 Johnson St., Brooklyn, N. Y. The larger size, illustrated, is designed to show the basis weight of bolts, nuts, screws and stampings or similar materials. When one of the pieces is placed in the pan, the



Amthor Direct-Reading, Quadrant-Type Scale

scale reads directly the net weight per 1,000. The accuracy of dimensions may also be checked on small parts by comparing their weight with a master or original piece. Different quadrants may be had for any special applications desired.

Both models are constructed on the gravity principle, eliminating springs and connecting pieces. The quadrant for the larger size consists of an arc 19 in. long and it has a radius arm 12 in. long. The pocket type, for light work such as determining the number of feet of cordage per pound from a 1-ft. sample, or for determining the number of square inches per pound of sheet metal, has an arc with a radius of 3½ in. This model is designed so that it can be disassembled and carried in a small case.

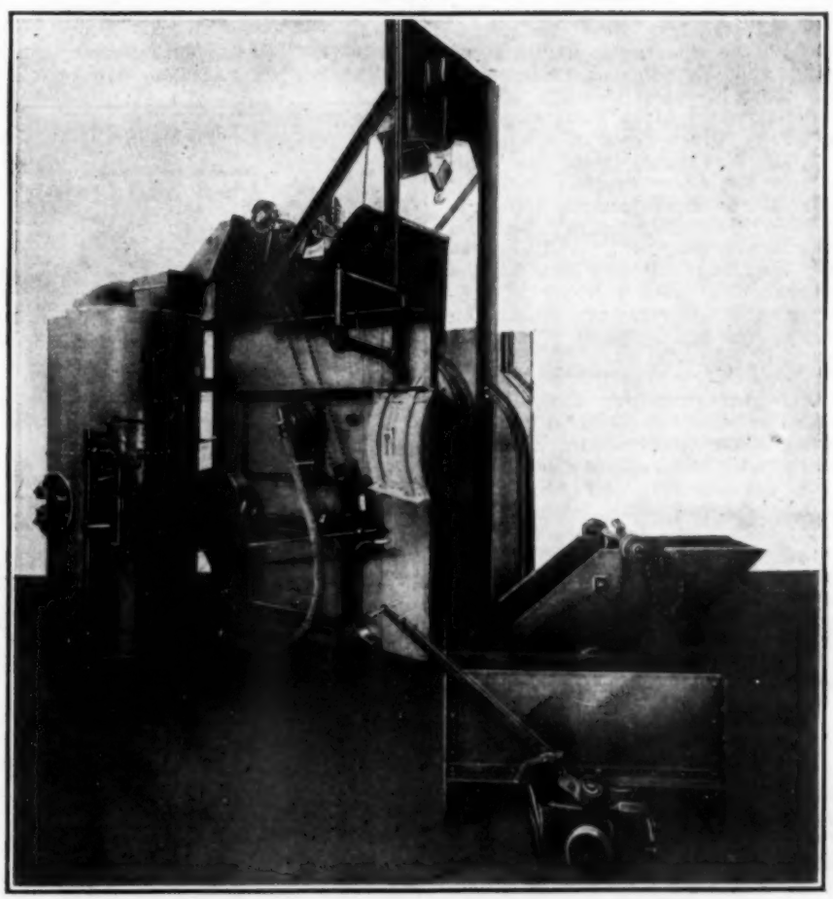
Pangborn Quick-Loading Sand-Blast Barrel

The Pangborn Corporation, Hagerstown, Md., has developed a sand-blast barrel intended to eliminate lost time that is often experienced in the loading and unloading of sand-blast barrel charges. A full charge of 16 cu.ft. is loaded in 35 sec., floor to floor time, made possible by an automatic loading device that is a feature of the machine.

A large door opening in the drum accommodates a steel skip, raised by trolley or crane, traveling on guides in front of the barrel in dumping position. Clearance under the barrel is sufficient to receive a receptacle large enough to contain the whole charge that is dumped by rotating the barrel. The barrel is of the direct-pressure type.

The sand-blast machine has two mixing chambers with individual lines to each nozzle of the barrel operated by a single control. The mixing chambers are heavy castings with large openings and passages to provide ample abrasive flow with larger nozzles at lower pressures. The nozzles are held in a ball-and-socket joint in frames on the side of the casting and can be removed quickly. All operating parts are on the outside of the sand-blast machine. Access to the interior of the sand tank can be made quickly through a choke-relief opening, without dismantling the mixing chamber or disconnecting the hose.

The capacity of the sand-blast tank is 5,000 lb. of sand or 12,500 lb. of steel abrasive, sufficient to clean more than the average load. The barrel drum is steel-tired and runs on manganese-steel rollers. All controls are on the sand-blast side of the machine for convenience of operation. A completely inclosed gear-reduction drive, made integral with the barrel, is interchangeable with a standard form of belt drive.



Pangborn Quick-Loading Sand-Blast Barrel

News of the Week

Foundrymen in Convention at Syracuse Consider Technical Side of Industry

Exhibition of machinery and equipment shows progress made in foundry practice—Root elected president

The technical side of foundry practice, including the study of the treatment of various metals, occupied the most important part of the program of the twenty-ninth annual convention of the American Foundrymen's Association, held at Syracuse, N. Y., during the week of October fifth.

This convention maintained the growing reputation of this branch of the metal-working industry for the interest of its members in the welfare and advancement of efficient foundry practices, the betterment of plant facilities, the strengthening of personnel appreciation and the importance of the technical aspect of foundry work.

Over three thousand were registered at the opening of the meeting on Monday and many more arrived during the following days. The convention was shared with the Institute of Metals Division of the American Institute of Mining and Metallurgical Engineers.

The first business meeting of the convention was held on Wednesday. At this session the address of the president, L. W. Olson, was the main feature. Mr. Olson touched on many phases of the metal-working industry, and laid particular stress on the strength and purpose of the association. He made a strong plea for the co-operation of each member in continuing the growth of association activity. He said in part:

Traces Early History

"This year completes the thirtieth in the life of this association and this meeting is the twenty-ninth. Many of the original founders have discontinued active participation and some have crossed the great divide. A new generation of workers has been in training and a new corps of leaders are in command. When this association was founded your president was still in his 'teens and had no tangible conception of a foundry nor any knowledge of its problems. Most enterprises having a modest beginning go through a period of difficulties and hardships and it is only because of the ability and courage of a few who took the lead that success finally came as a reward for their efforts. The American Foundrymen's Association owes its success to the unselfish effort of its founders and early leaders and also to the vision, courage and loyalty of a small group when, later on, it became necessary to incorporate.

"Like most successful and stable enterprises our growth has been slow but steady both in number of members and in amount of service renfered. It seems then that we are now on the threshold of a new period. Our membership growth is becoming more rapid. Your assistant secretary, Mr. R. E. Kennedy, is directing the technical activities of our association in a very able way and the results of his efforts are becoming manifest. A larger number of our members are from time to time entering into participation in our activities. We are today accorded the recognition we deserve by other societies and associations. We are being invited to participate in investigations, standardization and research. The direct result of all this is a wider scope in our activities and a participation through committees and conferences by a larger number of our members in a large variety of activities.

A. B. Root, Jr.

"There are primarily two obligations that every member owes to his association. The first is to contribute from his experience, knowledge and ability to the work of the association and the second is to use his influence to procure new members. Any organization large or small is effective in its results in increasing the sum total of human knowledge not so much through any super intelligence vested in one or a few directing minds, but more through the accumulative effort of all these minds working in harmony and with a complete understanding among them as to abilities and achievements, and willingness to give and take. No man is more unfortunate than he who thinks he knows it all, and on the other hand no man can be more fortunate than he who has a large circle of friends and acquaintances who are willing to give help and advice from their knowledge and experience.

"I consider myself very fortunate in having had the opportunity of close contact with many of the leaders in the foundry industry, and I can therefore perhaps appreciate the more fully the benefits and advantages that accrue from a free interchange of ideas and experiences.

"Continued growth and success of our association must mean continued growth and success of the industry that you and I are engaged in. It matters little whether we are in it through choice or circumstance, my plea to you is to avail yourselves fully and become more useful by your participation, interest and effort."

A. B. Root Succeeds Olson

Next on the program was the election of officers and the balloting resulted in the selection of A. B. Root, Jr., mechanical engineer with the Hunt-Spiller Manufacturing Co. of Boston, as president to succeed Mr. Olson. Other officers chosen were: Stuart Wells Utely, of the Detroit Steel Castings Co., vice-president; C. E. Hoyt, secretary-treasurer; Robert E. Kennedy, assistant to Mr. Hoyt. Directors chosen were: L. W. Olson, C. E. Hoyt, J. L. Jones, H. S. Simpson and Fred Erb.

At this session the announcement was made that the S. Obermeyer Award for the most deserving contribution of the year to the foundry industry, was awarded to the United States Radiator Corporation, of Detroit. The award was based on that company's perfection of a device for continuously recording the temperature of iron being delivered from the cupola.

At a meeting of the board of directors a resolution was adopted expressing the appreciation of the association to Robert Alexander Bull for his long service as a member of committees and as an officer of the association. At this meeting it was also announced that the next annual meeting of the association would be held in Detroit in September of next year.

The papers presented at the tech-

nical sessions covered a wide range of topics of interest to foundry executives and mechanical and metallurgical engineers. The sessions were divided so as to group the non-ferrous types, gray-iron foundry, general topics, aluminum and its alloys, foundry costs, apprentice training, foundry refractories, steel foundry practice, foundry management, sand research and control, malleable cast iron and the metallurgy of cast iron. Certain of the papers were of particular interest to the machine tool industry. Among others are mentioned:

"Permanent Mold Aluminum Castings and Their Field of Usefulness," by J. B. Chaffe, Jr., of Cleveland.

"X-Ray Examination of Aluminum Alloy Castings for Internal Defects," by Robert J. Anderson, of Cleveland.

"The Effect of Heat-Treatment on the Properties and Microstructures of Grey Cast Iron and Semi-Steel," by O. W. Potter, of Minneapolis.

"The Electric Melting of Cast Iron," by George E. Lamb, of Hoquiam, Wash.

"A Consideration of the Annealing Operation in the Malleable Foundry," by C. J. McNamara and C. H. Long, of Milwaukee.

"Aircraft Castings in Aluminum Alloys," by Samuel Daniels, of Dayton.

"Nickel and Nickel-Chromium in Cast Iron," by F. H. Wickinden, New York, and J. S. Varrick, of Bayonne, N. J.

"Mechanical Properties of the Aluminum-Copper-Silicon Alloy as Sand-Cast and as Heat-Treated," by Samuel Daniels and D. M. Warner, of Dayton.

Two Hundred Exhibits

Fully as important as the technical discussions was the exposition of foundry equipment, supplies and machinery, which with nearly two hundred exhibits filled all the available space in the two main buildings at the State Fair Grounds. The value of the exhibits was estimated at half a million dollars.

Many of the machines were shown in operation, power being furnished from electric sources and also from air compressors which were included in the exhibit. Molding machines, sand slingers, tumbling barrels, hammers, drills, and an electric melting furnace, all at work, gave an atmosphere of animation to the scene and enabled the many visitors, who were there for the purpose, to select equipment that was shown in actual operation.

The exhibit was about evenly divided between equipment intended primarily for the foundry, and that which would ordinarily find its principal application in the machinery industries. The visitor could turn from the study of melting furnaces, molding machines, core oil, sand slingers, cupola chargers, vibrators and foundry supplies to view lathes, milling machines, die sinkers, saws, drilling machines, screw machines, electric and pneumatic hoists and tools of all kinds. Grinders, sand-blast equipment, conveyors, flooring, welding equipment, metals, tractors and crucibles were among the many items on display.

Among the companies having exhibits of particular interest to the readers of *American Machinist* were the following:

Air Reduction Sales Co., New York, N. Y. Ajax Metal Co., Philadelphia, Pa. Ajax Wrench Corporation, New York, N. Y. Alloys and Products, Inc., New York, N. Y. American Brake Shoe and Foundry Co., Chicago, Ill. American Engineering Co., Philadelphia, Pa. American Foundry Equipment Co., New York, N. Y. Arcade Manufacturing Co., Freeport, Ill. Armstrong-Blum Manufacturing Co., Chicago, Ill. E. C. Atkins & Co., Indianapolis.

C. O. Bartlett & Snow Co., Cleveland, Ohio. Chas. H. Besly & Co., Chicago, Ill. Bethlehem Steel Co., Bethlehem, Pa. Bradley Washfountain Co., Milwaukee, Wis. C. C. Bradley & Son, Inc., Syracuse, N. Y. Bridgeport Safety Emery Wheel Co., Bridgeport, Conn. British Aluminum Co., New York, N. Y. Buckeye Portable Tool Co., Dayton, Ohio.

Carborundum Co., Niagara Falls, N. Y. Carter Bloxonend Flooring Co., Kansas City, Mo. Chicago Crucible Co., Chicago, Ill. Chicago Pneumatic Tool Co., New York, N. Y. Chisholm Moore Manufacturing Co., Cleveland, Ohio. Clark Tructractor Co., Buchanan, Mich. Cleveland Pneumatic Tool Co., Cleveland, Ohio. Clipper Belt Lacer Co., Grand Rapids, Mich.

Henry Disston & Sons, Inc., Philadelphia, Pa. Joseph Dixon Crucible Co., Jersey City, N. J.

Electric Furnace Co., Salem, Ohio. Elwell Parker Electric Co., Cleveland, Ohio.

Fanner Manufacturing Co., Cleveland, Ohio.

Gardner Machine Co., Beloit, Wis. General Electric Co., Schenectady, N. Y. Globe Steel Abrasive Co., Mansfield, Ohio.

R. G. Haskins Co., Chicago, Ill. Holcroft & Co., Detroit, Mich.

Independent Pneumatic Tool Co., Chicago, Ill. Ingersoll-Rand Co., New York, N. Y. International Nickel Co., New York, N. Y.

Jennison-Wright Co., Toledo, Ohio.

Kane & Roach Co., Syracuse, N. Y. Keller Mechanical Engineering Corporation, Brooklyn, N. Y. Wm. H. Keller, Inc., Grand Haven, Mich.

Lamson Co., Syracuse, N. Y. Lava Crucible Co., Pittsburgh, Pa. Leeds & Northrup Co., Philadelphia, Pa. Link Belt Co., Chicago, Ill. Louden Machinery Co., Fairfield, Iowa.

Macleod Co., Cincinnati, Ohio. C. E. McArthur & Co., Chicago, Ill. Mathews Conveyor Co., Ellwood City, Pa. Monarch Engineering & Manufacturing Co., Baltimore, Md. Morse Chain Co., Ithaca, N. Y.

New Haven Sand Blast Co., New Haven, Conn. Norma-Hoffman Bearings Corporation, Stamford, Conn. Norton Co., Worcester, Mass.

George Oldham & Son Co., Baltimore, Md. Oliver Machinery Co., Grand Rapids, Mich. Osborn Manufacturing Co., Cleveland, Ohio. Oxweld Acetylene Co., New York, N. Y.

Pangborn Corporation, Hagerstown, Md. J. W. Paxson Co., Philadelphia, Pa. G. W. Perks & Co., Akron, Ohio. Pittsburgh Crushed Steel Co., Pittsburgh, Pa. Porcelain Enamel & Manufacturing Co., Baltimore, Md. Porter-Cable Machine Co., Syracuse, N. Y.

Rivett Lathe & Grinder Co., Boston, Mass. Rollway Bearing Co., Syracuse, N. Y. P. H. & F. M. Roots Co., Connersville, Ind. Ross-Tacony Crucible Co., Philadelphia, Pa. Ruemelin Manufacturing Co., Minneapolis, Ind.

Safety Emery Wheel Co., Springfield, Ohio. Safety Equipment Service Co., Cleveland, Ohio. Shepard Electric Crane & Hoist Co., Montour Falls, N. Y. Simons Paint Spray Brush Co., Dayton, Ohio. Skybryte Co., Cleveland, Ohio. W. W. Sly Manufacturing Co., Cleveland, Ohio. Spencer Turbine Co., Hartford, Conn. Steel City Testing Laboratories, Detroit, Mich. Sterling Wheelbarrow Co., West Allis, Wis. Sullivan Machinery Co., Chicago, Ill. Swartwout Co., Cleveland, Ohio. Syracuse Supply Co., Syracuse, N. Y.

Tiona Petroleum Co., Philadelphia, Pa. Transmission Ball Bearing Co., Buffalo, N. Y. Truscon Steel Co., Youngstown, Ohio.

United States Graphic Co., Saginaw, Mich.

Warner & Swasey Co., Cleveland, Ohio. Westinghouse Traction Brake Co., Pittsburgh, Pa. Whiting Corporation, Harvey, Ill. G. H. Williams Co., Erie, Pa. Worthington Pump & Machinery Corporation, Cincinnati, Ohio. Wright Manufacturing Co., Lisbon, Ohio.

Yale & Towne Manufacturing Co., Stamford, Conn. Young Bros. Co., Detroit, Mich.

The annual banquet of the association, held on Thursday evening, was the occasion for the presentation of two medals for meritorious work in the industry. The Joseph S. Seamon gold medal was awarded to Dr. Richard Moldenke in recognition of his many contributions to the foundry industry. The W. H. McFadden medal was awarded to Dr. Robert J. Anderson for his work in assisting at the technical sessions of the organization.

Engineers Will Discuss Research and Science

The Engineers Club of Philadelphia has arranged a very attractive program for its meeting on the evening of Oct. 20 in the auditorium of the clubhouse, Spruce St., Philadelphia. E. B. Craft, executive vice-president of the Bell Telephone Laboratories, will deliver an address on "Today's Research—Tomorrow's Engineering." The address will tell of some of nature's secrets that are being revealed by research and study, and how industry will profit by them. It will cover work that is being done along industrial lines as well as the value of such research. Dinner will be served for those who make reservations.

A.S.M.E. Discusses Railroad Problems at Altoona Regional Meeting

Honorary membership conferred on General Atterbury

A regional meeting of the American Society of Mechanical Engineers was held at Altoona, Pa. on Oct. 5 to 7, at the Penn-Alto hotel. The Pennsylvania R.R. and the Central Pennsylvania Section were hosts and provided an interesting program for the meetings, which were well attended by members from both East and West. An especially interesting feature of the meeting was a reunion of a number of the members who attended the meeting of the A.S.M.E. in 1883—forty-two years ago, among them being George Bond, of Hartford, Conn., Ambrose Swasey and Worcester Warner.

Dr. Wm. F. Durand, president of the A.S.M.E., came up from the Aircraft Board hearing in Washington to preside at the first meeting at which the address of welcome was delivered by Elisha Lee, vice-president in charge of operations of the Pennsylvania R.R Honorary membership was bestowed on Gen. William Wallace Atterbury, who has recently succeeded Samuel Rea as president of that railroad.

The session of Tuesday, Oct. 6, was presided over by Dean Kimball in his usual happy manner and included addresses from Samuel Rea on "American Transportation"; on the "Locomotive Testing Plant and its Influence on Locomotive Design," by Lawford H. Fry; and "The Transportantion Industry and the Engineer," by Samuel P. Bush. Mr. Rea traced the development of transportation since the last meeting at Altoona in 1883, pointing out the advent of both motor transport and airplane and the probable effect on the transportation problem. Mr. Fry gave specific examples of how data secured in the testing plants, particularly the plant at Altoona, had aided improvements in the design of locomotives that had increased their efficiency in various ways. The paper by Mr. Bush was largely a plea for greater consideration, or leniency, in dealing with railroads, although he pointed out a few instances whereby the efficiency of operation and management might be open to improvement.

In the afternoon an excursion was arranged to take the visitors to the old Portage railway where canal boats were hauled over the Allegheny Mountains before the rail connections had been completed. This involved an interesting trip over the "mule shoe," a route that is now only used for freight, coming back into Altoona over the famous horseshoe curve. A drizzling rain marred an otherwise most enjoyable trip.

The technical session on Wednesday heard an address by A. J. County, one of the vice-presidents of the Pennsylvania R.R., on the growth of a great railway system. Dr. M. E. McDonnell, chief chemist of the same railroad presented a valuable contribution on the "Rustproofing of Materials," and Robert S. Binkerd, vice-chairman, committee on public relations of Eastern railroads, spoke on "The Railway as an Economic Force."

The afternoon was devoted to an inspection of the Altoona Works of the Pennsylvania R.R., particular attention being given to the locomotive test plant, on which was mounted one of the new, large electric locomotives recently completed for the Pennsylvania. From here the party visited the Juniata shops, thus closing the largest regional meeting ever held here.

Operation and Design Problems Discussed at Aeronautic Meeting of S.A.E.

Air mail service and Ford air lines described

As a curtain raiser to the national air races on Long Island, the Society of Automotive Engineers staged an aeronautic meeting and banquet on Oct. 7 at the Hotel Astor in New York City. At the afternoon session four speakers were heard. Henry M. Crane, consulting engineer for the General Motors Corporation, spoke on the Aeronautic Safety Code sponsored by the society, and said that efforts are to be made to encourage its adoption by those interested in all branches of flying. Mr. Crane is strongly opposed to legislation that would write any part of the code into the law of the land, as he feels that such action would hamper development.

The next paper was on the "Evolution of the Racing Plane," by W. L. Gilmore, of the Curtiss Aeroplane and Motor Co., the man who has done most to develop this type of ship. Mr. Gilmore was unable to leave the factory because of the imminence of the Pulitzer Trophy Race in which his planes are entered and the paper was therefore read by C. W. Keys, president of the Curtiss company.

The paper outlined the various advances in fast plane design that have been made since the war and brought out the value of the racing plane as a sort of experimental laboratory device with which to test out new ideas that could later be applied to commercial craft.

A paper on "Light Airplanes and Low Powered Flying," was read by W. L. LePage, of the Gardner Publishing Co. In it the writer pointed out the differences in the design problems relating to light and standard planes.

The last speaker of the afternoon session was George J. Mead, chief engineer of the Pratt & Whitney Aircraft Co. Mr. Mead traced the recent developments in aircraft engines and showed slides and motion pictures to illustrate his points. He explained in some detail why air-cooled radial engines are more suitable for airplane use than the automobile type of engine, and showed how they are gaining ground.

At the banquet C. W. Keys, president of the Curtiss Aeroplane and Motor Co., was the principal speaker. He said that the general board of the Navy and the general staff of the Army, while experts in technical activities know nothing about aviation except "a very general smattering of incomplete knowledge based upon hearsay." As proof of his statement he quoted a member of the navy board as saying that the best long-range naval airplane ever built was designed and built by the Navy seven years ago, meaning the NC-4 which crossed the Atlantic. As a matter of fact, this ship was designed and built by the Curtiss company and is now obsolete.

Investigation Is Profitable

Mr. Keys said that the impression, apparently current here, that Great Britain is about to abolish the separate air service is entirely erroneous. He further said that he believed that the present investigation is doing great things for aviation and that no matter what its recommendations the high officials in military and naval circles have learned much from it.

Another technical session followed the banquet. J. P. Van Zandt, of the Department of Commerce, speaking on "Reliability as a Factor in Air Transportation Efficiency," compared the records of airplane and train mail transportation. Based on a ground speed of 70 m.p.h., or 25 miles less than the cruising speed of the air mail planes, the efficiency of the plane is higher than that of the train. Because of the possibility of adverse winds it would seem wise to make such a reduction on cruising speed when setting up schedules. The only alternative is to keep the present schedule and use faster planes.

A paper on "Air Mail Operation" was presented by J. E. Whitebeck of the U. S. Air Mail Service.

The last paper was by W. B. Stout, president of the Stout Metal Airplane Co., which builds the all-metal monoplanes used by the Ford Motor Co. Mr. Stout's subject was "Ford Air Line Operation," and he made the following points:

A commercial airplane is an air vehicle that can support itself in the air financially as well as mechanically.

That plane is the most commercial that can earn the greatest dividend under the widest range of conditions.

If an airline has not safety and reliability, it cannot earn a dividend.

The two major requirements necessary before we will have real commercial aviation are a real airplane engine and absolutely dependable navigating instruments.

Aviation laws and all the landing fields in the world cannot bring commercial aviation until we have commercial planes.

British Engineering Industries Are Quiet

Automobile and electrical goods manufacturers show greatest activity —Plan immediate cultivation of foreign markets— Railroads buying heavy tools

By Our London Correspondent

THE story of the British engineering industry is very quickly told, for general conditions have not materially changed recently, and it may be said that while the few branches that were in fairly good position a month or more ago remain there, the rest show no great advance. The two sections which can claim to be prosperous are the automotive industry and electrical engineering. The wireless section of the latter, after the summer decline, continues to grow. The heavier sections remain well occupied.

The seasonal rush for motor cars has of course long passed, but the date of the annual show in London was brought forward and this has meant some hurrying of the work of preparation of new models to be introduced. Most changes, however, are hardly matters of moment, but the amount of reorganization or of additions to manufacturing processes needed has had some effect on the lighter side of the machine tool industry, and of course in one or two cases a definite extension of motor car works has been put in hand.

A more vigorous and better organized attempt is to be made to cater to the overseas, and specially the Dominions markets. The improvement in the automotive industry is shown by the recent admission of a leading firm that up to the end of 1924 the accumulated debit balance was of the order of one and a half million pounds, while the net profits for the current year alone will exceed half a million pounds.

Large Order from Poland

The motor car industry is in fact responsible for the largest overseas order received for a long time by the British machine tool industry, namely, the complete equipment of the first motor car factory to be operated in Poland. The value of the contract amounts to about 360,000 dollars. Before the order was obtained one of the Polish principals toured parts of England in order to see the machine tool factories likely to be concerned, and made comment on the British machine tool industry, including reference to the unattractive manner in which British machines were put forward, presumably by way of advertisement; the lack of capital in the British machine tool works visited; and the British desire for individuality in design, suggesting as a part remedy the copying of American manufactures. The other direction in which machine tool firms have been able to obtain orders lies in the railway shops. These have continued and are continuing to call on machine tool manufacturers, mainly for the heavier tools. Once again business in this direction has been maintained much better than some firms had anticipated, and the railway situation in France is such that hopes of orders from that area are being entertained.

But the general condition of the machine tool industry is hardly less unsatisfactory than for some months past. Apparently more of the weaker brethren are disappearing. Within a recent fortnight four firms closed down. All were of fair age, one of them having been in existence since 1832. On the other hand, improvement can be recorded, two firms reporting profits as the result of the past year's working, though no dividends have been paid. Another firm, with part of its works engaged on capstan lathes, has had to go on night work for a period.

Most, if not all, of the ball-bearing manufacturers have been pressed and production means have been increased. American centerless grinders, for instance, having been installed. But the sales of imported bearings have not been brisk, except perhaps in cycle bearings. Part of the explanation may perhaps be found in the fact that some motor car firms bought well in advance of the re-imposition of the 33⅓ per cent duty; this has to be paid on the imported ball bearing if it is to be embodied in a car.

Both makers and users of presses and press tools are well engaged, the adoption of stampings in the construction of airplanes being responsible to an extent, but recent failures of the airship have acted as a damper on other developments. Some local reports suggest that manufacturers of lifting gear and appliances are satisfactorily engaged. As for many months now, woodworking machinery firms could handle more business.

Railroad Equipment Quiet

Outside the railway company shops, locomotive building works have for the most part been in an unsatisfactory state. It is true that several orders—but mostly of no great amounts—have been reported, and locomotives of various kinds are to be supplied to Brazil, Argentine, India, South Africa and Australia, and a number of locomotives are being sent to China, though these are war surplus plants reconditioned. Certain of the Australian locomotives under way will be the largest yet made in this country, the total engine and tender weight being nearly 220 tons, the tenders having a water capacity of 8,000 gallons. An unusual feature is the specification of bar frames.

The textile machinery trade is still only partly employed, though a number of inquiries have been reported, and the home textile industry has been ordering to some extent. Also, as the result of a visit by representatives of textile interests in Russia, some orders have been accepted for that country by two or three firms, who will be kept in employment for several months. But for the most part the banks refused to give the necessary support, and nothing like the full requirements of the Russian delegation will be met in this country.

The shipbuilding industry remains unsatisfactory, and slowly shipyards are being closed. Some districts, including the important one of Belfast, have reported a fair measure of employment, but, on the other hand, a definite decline is noted at Clyde.

Put shortly, the British engineering industry is the creature of the general economic conditions prevailing.

Commerce Figures Show Imports on Increase

An increase in imports for each one of the first six months of 1925 over corresponding months of 1924 is disclosed by an analysis of the foreign trade of the United States for the first half of 1925, made by the foreign commerce department of the Chamber of Commerce of the United States. Imports for the January-June period of 1925 totaled $2,066,679,000, an increase of 11.7 per cent over the same period of 1924. This is in part a reflection of higher prices of such commodities as rubber, coffee and textile fibers.

A complete shake-up of rank occurred among our leading imports in a value comparison of the first six months of 1925 with those of 1924.

Raw silk, with a total value of $171,704,000, a gain of 20 per cent over the $143,871,000 of January-June 1924, moved from second place to first, displacing cane sugar, imports of which were valued at only $154,547,000, compared to $240,166,000 a year ago. Crude rubber values, thanks more to inflated prices than to increased quantities, rose from forth to third place, exchanging with coffee. Imports of rubber totaled 148,144,000, as compared to $87,429,000 for 1924, a gain of 69 per cent.

Increased imports among the big statistical groups included the rubber-tobacco group, animal products, textiles, chemicals, the wood-paper group, coal-petroleum, metals, and machinery. The declines were in vegetable foodstuffs and vehicles.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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IN NEW YORK the tide of business is now at the autumnal flood. The metropolitan district has a population of about 10,000,000 persons who do all their buying here, and it is quite possible that the New York shops supply another 10,000,000 visitors or mail order customers with a large portion of the clothing, furniture and jewelry that they purchase.

The result is an enormous volume of business which rises to the peak in the autumn when many of these non-residents come here to swell the crowds, add to the traffic jam, fill the hotels and provide audiences for the sixty-five theaters that are now open.

This year the autumnal activity and expenditure are greater than usual, because we have a bull stock market and the profits made there are being lavishly spent for costly luxuries and entertainment. Therefore if one were to generalize from what is to be seen here he would conclude that the whole country was not only prosperous but opulent and that there was no limit to its purchasing power or its willingness to buy.

But fortunately, or unfortunately, Fifth Avenue and Broadway do not reflect conditions throughout the nation, and when one looks West or South less extravagance and more circumspection in buying is to be seen. This is not to say that there is any indication of a depression presently or prospectively, but it is becoming plain that the declines in grain and cotton and the unemployment of the striking coal miners in both the anthracite and bituminous fields are commencing to have a discernible effect upon business sentiment in the hinterland.

Meantime opera seats have been advanced to $8.75, which means that most people will have to pay at least $10 for them; memberships in the New York Stock Exchange have sold at $125,000, which is the highest price on record, and the stock market is intermittently buoyant despite the advance in the call money rate, which now goes to 5 or 5½ per cent every few days.

The relation between business and the opera or the Stock Exchange may seem rather remote to some, but it is not to be disregarded, for the extravagance and speculative excesses of the metropolis, being widely advertised, often incite agrarian discontent when agricultural prices are declining. The arraignment of the recently created "$400,000,000 Baking Trust" by the Federal Trade Commission bespeaks this feeling and, although the Coolidge administration seems to favor business consolidation, it is quite possible that it may have gone far enough.

But this is a larger and long distance view of an exceedingly complex and puzzling situation. There is no doubt that business is good and, while the pæans of prosperity that are being published in some of the newspapers are hardly justified, an active trade until Christmas seems indicated unless something catastrophic occurs.

But it is also plain that the stock market is at a dangerous level, that the supply of credit upon which the present movement depends is being gradually depleted and that the investment demand for new issues is approaching satiety.

Therefore the conservative will continue to be cautious, for there does not appear to be any circumstantial basis for the theory that the Federal Reserve Banks have agreed not to raise the rediscount rate unless the Bank of England does likewise.

An eye should also be kept on financial conditions in France. The franc fell below 4.60 upon Caillaux's departure from this country. It has since rallied slightly upon an announcement from the French minister of finance that the bears would be harshly dealt with, but the new gold parity bonds are selling but slowly and one cable suggests that coercive measures may be adopted to induce their acceptance in exchange for the internal loans now maturing.

But these are about the only clouds that are visible and it must be admitted that they have not chilled the prevailing optimism. The railroad traffic is surprisingly large when the reduced movement of grain and coal is considered. Railroad earnings are large, so are bank clearings, and the retailers as well as the mail order concerns continue to report large sales.

A further improvement in the demand for iron and steel is likewise reported, but copper continues strangely unresponsive to the upward impulse manifest in the market for other metals. The F. W. Dodge Corporation says that the cost of the new construction undertaken during the first nine months of this year will exceed the expenditure for the whole of 1924, and while this seems to bring the point of saturation in new building nearer it is generally construed as presently encouraging.

There have been no changes that are significantly important in the other commodity markets. Distributive trade is good and silk and woolen textiles as well as cotton fabrics are being freely bought. The shoe trade continues to improve and the automobile manufacturers seem confident of the future.

A feeling of confidence is widespread, and unless Congress does something to alarm people there is no reason why there should be any change in the near future.

What's Doing in Industry

The first half of October shows a decided upward change in the trend of machine tool and machinery sales figures. The latter part of September slacked off somewhat, for no apparent reason, but the early days of this month have brought some substantial business and indications are that the fall season has started in full swing and will continue along conservative lines for the next two months.

The Mid-West still holds the lead in volume of sales. Detroit reports the automotive industry buying special machines for new factory units. Cincinnati is experiencing an all-around improvement in demand, orders coming from unexpected sources. Milwaukee reports an increase demand from manufacturers of farm machinery, and Chicago expects that this month will be the best in several years.

The South is making encouraging progress with large industrial projects and machinery sales are expected to increase. New England reports an appreciable increase in orders and inquiries. The New York market shows business improving, with renewed activity from railroad sources.

In the general business world there is little to disturb the even course of trade at this time of the year. Speculation in the stock markets has been checked to some extent, and with no radical shift in the commodity markets the fall should be a prosperous season for all.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

New York

Early indications are that the month of October will show better business in machine tool figures than was the case last month. September showed a decided slowing up toward the latter part of the month, but October has opened up auspiciously and current orders are far ahead of the first half of last month, and also better than the same period of last year.

A few new inquiries for single tools have been issued by railroads in this section: industrials are quiet as far as placing large orders, but are buying freely of single machines for special production work.

Among the orders placed during the past week were: Central Railroad of New Jersey, a 6-ft. radial drill, a 48-in. car wheel borer, and a large axle lathe: the Kentucky & Indiana R.R. Terminal Co., a 90-in. driving wheel lathe, a 48-in. car wheel borer, a large steam hammer, one 96-in. wheel press, one 5-ft. radial drill and a large axle lathe; the Nickel Plate R.R., a 90-in. lathe; the Wabash R.R., two 25-ton, 60-ft. span electric traveling cranes; and the A. O. Smith Corporation, three special horizontal and cylindrical scarfing and facing machines.

Philadelphia

With the approach of fall, machinery and machine tool dealers in Philadelphia are confident there will be an increase in orders sufficient to warrant a fairly active season. None of the producers or dealers are in a position now to forecast an immediate return to quantity buying, but there is an undertone denoting a favorable basic condition.

Evidence of business improvement in most lines is at hand, according to indications from most retail and wholesale dealers. Retail trade was greater last month than it was in September of last year.

Reports to the state authorities show that employment in most industries over which statistics are kept, has taken an upward turn.

More than $56,000,000 worth of work is under contract in connection with the building of the city's subway system, and the work is not yet fairly started toward completion.

Southern District

A fair increase in tool and equipment sales the last two weeks is reported by dealers in Atlanta, the volume of business the last half of September not only exceeding that of the first half of the month, but also bettering the corresponding period of last year.

The fall and early winter outlook is particularly good in the Southern territory, distributors in Atlanta believe, due to the fact that general business conditions are very favorable, and that production by the keynote industries of the district for the past three months has materially exceeded the same three months in 1924.

A fair idea of the prosperity of the agricultural industry in the South this year may be noted from the fact that the larger distributors of tractors and power farming equipment reported a gain in sales during August of 125 per cent, as compared with August business in 1924; while June to August inclusive, averaged better than a 60 per cent increase over the same three months last year.

Service stations and garages, and smaller machine shops, are fairly active in the market, but mostly for used or rebuilt equipment. The textile and woodworking industries also are active buyers right now, while the railroads continue to purchase on a good basis of heavier tools and equipment.

Cincinnati

The feature of the machine tool market in the past week, according to Cincinnati manufacturers and selling agents, is a general all-around improvement in demand, with orders from industries that have done little or no buying for quite a while.

The textile industry is reported to have done some buying in the past week, and this has temporarily shifted the center of demand to the East with some concerns. The automotive industries bought less freely than in the previous week, but it is commonly felt that this is but a temporary lull.

Railroads have placed some orders for single tools, and there have been a few export shipments. The demand for used tools has shown some increase, according to reports of dealers, but this branch of the trade is still dull.

At one factory it was reported that the week opened up with a shower of orders from all sections. At another it was reported that the week has been exceptionally fine. At still another it was reported that the market has become much more active, with a decided increase in demand, especially for the smaller tools.

According to reports received from the local trade in general, it seems that sales and inquiries are about equally divided between the East and the West, with good diversification as to sizes and types of tools required.

New England

The past fortnight has witnessed an appreciable increase in the amount of contract business placed in the New England territory, and also an increase in inquiries. Automotive parts requirements are estimated by manufacturers to be from 10 to 25 per cent greater than a year ago. Delivery dates are an important factor in placing business.

Demand for automatic machinery is improving, and builders in Hartford, New Britain and Bridgeport, with sales records of nine months before them, report that the year will show a substantial improvement. Export deliveries have been especially good.

Requirements for hand tools are of fair volume. Foundrymen making castings report that contracts for the past six months show a steady upward trend.

Milwaukee

Signs of a healthier condition in the metal-working industry are coming to light with greater regularity, and the sentiment concerning fall and winter business for manufacturers of machine tools is more cheerful. The demand for equipment appears to be continuing along the broadening line that characterized September business, with a greater diversification of sources.

The main demand still is attributable to the automobile trade. A few of the larger power farm machinery concerns in this territory are making the most important purchases in a number of years, yet the total embraced by these orders remains smaller than in more nearly normal years. Equipment trade finds its real substance in the purchases being made for replacement.

Used tool stocks as a rule contain few items representing the most advanced types of machines, so that buyers usually are compelled to purchase new equipment. In the matter of replacement of more or less obsolete tools, the types coming back to the market for re-selling have little appeal and move slowly.

Milwaukee employment figures for the past month show another small but gratifying increase over the previous month. In metal trades shops the number employed is now getting close to the peak reached in March, 1923.

Detroit

No noticeable change has occurred within the past fortnight in the Detroit market for machine tools and machinery, although the tendency is away from the record sales which have featured the summer months.

While some of the dealers in machine tools report a falling off in purchases, some of those handling special machinery declare that several of the large automobile factories are planning extensions during the next quarter.

A number of recent announcements portend an active market for machinery and tools, much of it of a highly specialized nature. Production of the new Hupmobile Six is under way, and as a result the Hupp Motor Car Corporation is buying more machinery than for some time.

The building program of the Ford Motor Co. at its River Rouge plant is progressing and large sums are being expended for electric heat-treating furnaces, punch presses, curling machines, hydraulic presses and upsetting machines.

Engineers at the Oakland Motor Car Co. plant at Pontiac are placing orders for part of the machinery necessary for the production of the new General Motors Corporation car which is to be built at the Oakland factories.

The Lindell Drop Forge Co. of Lansing, Mich., has been a buyer of drop forge equipment for its factory addition. The Michigan Electric Power Co. is completing the installation of entirely new equipment in its plant at Lapeer, Mich.

Chicago

If the volume of business transacted in machine tools during the first week in October be maintained throughout the month at the same ratio, the Chicago district will enjoy one of the best month's trade in some years. Almost without exception dealers in new and used machinery express satisfaction with conditions as developed thus far in October.

This satisfaction is enhanced by the fact that not only inquiries received, but actual sales consumated cover a much wider range of industrial demand than during preceding months. Concerns which have been depending largely upon railroads, automotive and radio manufacturers' requirements are now dealing with a much more extended clientele.

This is taken as an indication that production throughout the Middle West is on the up-grade, and that plants which have continued to operate with machinery after it had become practically worn out, are coming into the market for new equipment.

Soviet Trade Grows With Local Agent

The Soviet government's attitude toward foreign business is illustrated by the changed position of the Allied American Corporation established in Moscow in 1921. The first concession under the new economic policy was granted to the company in the shape of an asbestos mine in the foothills of the Ural Mountains. Asbestos at first was unprofitable owing to lack of Russian demand for low-grade fiber. The demand is now sufficiently developed for the mine to make a small profit for the current year.

In order to recoup its losses the Allied American two years later obtained an agreement with the Foreign Trade Monopoly Bureau to handle general importation and exportation business on a fifty-fifty profit-sharing basis. In 1924 the American company made a very substantial profit, which it shared with the Russian bureau. But improvement in conditions and foreign merchandising mechanism of the Soviet Government brought about a change in policy. The monopoly bureau exercised the right given by the contract with the Allied American to propose that the latter henceforth act not as a free importer and exporter, but in so far at least as import is concerned, as a buyer for the Soviet foreign purchasing departments on a commission basis. This involved considerable reduction in the selling organization the Allied American had built up in Moscow and the provinces, which gave rise to the unfounded report from Riga it had been forced out of business a short time ago by the Soviet Government.

On the contrary the American company has just received orders totalling 7,000,000 gold rubles for shoe leather and cotton yarn.

These orders will be executed in America but financed on medium term credits by London. The Allied American also has made a new contract with the Concession Committee — approved by the Council of Commissars on Sept. 22—to take over and re-equip two large pencil factories in Moscow. The Allied American Corporation maintains offices at 165 Broadway, in New York.

Test Strength of Wood Screws

It has often been said that little accurate information is available about certain properties of articles in common use. Some things are so commonplace and have been in use so long that we are apt to assume that nothing new is to be found out about them.

Take the case of wood screws. What is the holding power of a wood screw? How many pounds of force will it take to pull a wood screw of a given size out of some particular kind of wood? Industries that use wood screws have often asked these questions, but no one could give a satisfactory reply. To answer them would require a great many tests, because there are so many sizes and kinds of screws, many different kinds of wood, and numerous procedures for inserting the screws.

In an attempt to answer these questions the Bureau of Standards of the Department of Commerce has conducted tests of the holding power of over 10,000 wood screws of various sizes, in seven different kinds of wood—yellow poplar, cypress, sycamore, Georgia pine, North Carolina pine, hard maple, and white oak. The effect of various factors on the holding power, such as the use of a lead hole, and of a lubricant, have also been studied. It is believed that accurate data, the first of the kind on this important subject, will be secured as a result of this work.

News of the Automotive Industry

"We are producing 850 cars a day and by Jan. 1 we expect to produce 1,000 daily," said Walter P. Chrysler, chairman of the Chrysler Motor Co., just before sailing recently on the French liner Paris for a business trip abroad.

"I expect the motor car business to be as good next year as it has been this year, with most of the buying coming from the farmers. Earnings are excellent. From July, 1925, to July, 1926, we expect to export 15,000 cars."

Since the introduction of the Diana, light straight eight, the Moon Motor Car Co., of St. Louis, has found it necessary to increase production. 200,000 sq.ft. of floor space have been added to the Moon-Diana plant, by the acquisition of a new building immediately adjoining the St. Louis factory formerly occupied by the Frederick-Bascom Rope Co. Both the Diana and Moon plants are running at full capacity, while arrangements for increased production are being made as speedily as possible.

An airplane motor, which, after seven years of experimenting, has been developed by Captain Eddie Rickenbacker, considered by many as America's greatest ace in the World War, has been announced by Mr. Rickenbacker. Bulk production on a standardized scale will be started at the Rickenbacker factories in Detroit on Jan. 1, 1926.

The motor is a five-cylinder radial type, air-cooled, and will develop 80 hp. Its total weight is less than 150 lb. and its cost, Mr. Rickenbacker said, will be slightly less than $1,000.

A group of airplane manufacturers who have been in Detroit, at a private demonstration of the motor, predicted that it will give a decided impetus to commercial aviation.

The air-cooled motor type appears, in the opinion of the majority of engineers, to be the solution of the airplane power plant. Most of the trouble with motors experienced by fliers has been due to the radiation. Either the radiator would leak or the water would heat too quickly, or something else would go wrong with it.

Henry Ford said at the completion of the Ford tour, when told that all of the motor trouble experienced on the tour was due to radiation, that the air-cooled motor is the answer.

"We have been experimenting with air-cooled airplane motors for some time," he said then, "and the tests prove them to be highly satisfactory. I believe that the air-cooled motor will eliminate most of the engine trouble encountered by fliers."

Mr. Ford added that at present his engineers are working on an eight-cylinder double-V type motor of 200 hp. The double-V is similar to two X's placed one behind the other. His motor has a double crankshaft which eliminates practically all vibration.

"I have been criticised openly and otherwise for what appeared to be a complaisant, lackadaisical attitude on my part toward aviation since the war," Capt. Rickenbacker said. "However, I have been working on this motor ever since I was discharged from the Army.

"My aim has been to design an engine simple in construction and low enough in price to come within the means of almost everyone and make aviation a practical proposition for all.

"There are fewer parts in this new motor than in the motor of an automobile and the most amateur mechanic could repair minor troubles with ease."

Personals

R. D. HEFLIN, New York representative of the Gisholt Machine Co., of Madison, Wis., has opened offices in Room 502, at 2 Rector Street, New York City.

ROBERT H. KELLEY has resigned as secretary of the American Foundry Equipment Co., of New York.

J. H. WOOD has closed out his business in Philadelphia, known as the Eastern Machinery and Equipment Co., and has joined the sales force of the Southwark Foundry and Machine Co., of Philadelphia.

M. C. HATCH, formerly supervisor of machinery with the M. K. & T. R.R., has accepted the New England representation of the Davis Boring Tool Co. of St. Louis. He is located in the Essex Bldg., Boston.

WILLIAM MORGAN, for nine years special New York, Philadelphia and Baltimore representative of the Davis Boring Tool Co., St. Louis, Mo., is establishing permanent offices in New York City.

L. A. CARTER, president and general manager, has retired from active participation in the conduct of the Lehmann Machine Co. of St. Louis. Mr. Carter is doing private consulting work.

H. F. WHITE has resigned as superintendent of the plant of the Harker Manufacturing Co., Cincinnati, and has assumed a similar position with the Lockwood Manufacturing Co., also of Cincinnati.

J. J. CARTER has succeeded John M. Scott as factory manager of the Olds Motor Works at Lansing, Mich. Mr. Carter was transferred from the Remy electric unit of the General Motors Corporation.

F. A. DAUGHERTY, formerly in charge of the Lebanon, Ind., shops of the Terre Haute, Indianapolis & Eastern Traction Co., has been named acting superintendent of equipment to succeed J. W. Osborn, who resigned to take a position with the Cleveland & Southern Traction Co.

W. E. MOBERLY has resigned his position in charge of car wheel boring with the American Car and Foundry Co., St. Louis, to become a special railroad sales representative of the Davis Boring Tool Co., of St. Louis.

DON S. DEVOR, vice-president and director, and MATTHEW B. MORGAN, chief engineer, the Timken-Detroit Axle Co., have left for Europe to make an exhaustive study of gear production to prepare for a larger output and to embody in the product the latest ideas in the manufacture of worm and bevel gears. The Timken-Detroit organization has for a number of years specialized in gear making, and has collaborated with David Brown & Sons, Ltd., Huddersfield, England. The Timken-Detroit Axle Co. recently erected a large addition to its plant in Detroit.

EDWARD D. KILBURN has been elected a vice-president of the Westinghouse Electric and Manufacturing Co.

A. H. ELLERMAN has joined the sales staff of the Wagner Electric Corporation, of St. Louis. He has been assigned to the Kansas City office.

What the Railroads Are Doing

C. V. Burnside, assistant director of the Interstate Commerce Commission Bureau of Finance, has recommended in a tentative report that the commission deny the application of the New York, Pittsburgh & Chicago R.R. for authority to construct a 283-mile line across the state of Pennsylvania. The assistant director held that the present record was insufficient to approve the application, but stated that the case could be resubmitted with additional evidence that would give broader consideration to the public interest.

He found there is no urgent need for the proposed line as the existing railroads are handling the through traffic between New York and the west in a reasonably satisfactory manner, and can no doubt continue to do so by expanding the facilities as

required. He pointed out, however that the proposed line would have great advantages over existing routes, but not sufficient to establish fully its economic justification, which must depend upon the extent to which the saving in transportation costs will afford return upon the capital necessary to effect that saving.

Officers of the New York Central R.R. report that satisfactory operating results have been obtained from the gasoline-driven railroad cars which have been placed on two branch lines. A one-car unit is in service between Lake Mahopac and Golden's Bridge on the Harlem and Putnam divisions and a two-car unit runs between Canandaigua and Batavia, N. Y.

The experiment has attracted much interest among Eastern railroad operating officials, and will soon be extended to other lines. The New York Central has an order with the J. G. Brill Co. for additional gasoline-driven cars which will be put in operation on traffic lines on which steam trains are unprofitable. The Lehigh Valley and the Lehigh & Hudson River lines are also having trial runs made.

The Missouri Pacific R.R. will purchase 2,000 new automobile, box, stock and coal cars, five new standard steel dining cars and ten new heavy Santa Fe type freight engines, it was announced last week. One thousand new automobile and box cars will be bought by the International-Great Northern R.R. This is in addition to an order for new cars placed two weeks ago.

The Chesapeake & Ohio R.R. is inquiring for 30,000 tons of rails and the Erie is expected to enter the market for 40,000 to 45,000 tons. The New York Central may require 200,000 tons to meet its needs for the coming year.

The Department of Commerce announces that September shipments of railroad locomotives, from the principal manufacturing plants, based on reports received from the individual establishments, totaled 94 locomotives, as compared with 104 in August, and 104 in September, 1924.

Freight cars in need of repair on Sept. 15 totaled 190,674, or 8.2 per cent of the number on line, according to reports filed by the carriers with the car service division of the American Railway Association. This was a decrease of 6,504 cars under the number reported on Sept. 1, at which time there were 197,178, or 8.4 per cent.

Business Items

Oste, Gonzalez & Cia is the name of a company that has just been formed at Mazatlan, Mexico, to deal in machine tools and all kinds of industrial machinery.

The Swedish Iron and Steel Corporation is the new name of the Federal Tool and Alloy Steel Corporation, of Brooklyn, N. Y.

S. W. Platt & Co., of McKees Rocks, Pa., have opened offices at 708 Oliver Bldg., in Pittsburgh.

The Reading Chain and Block Co., of Reading, Pa., has opened offices at 90 West St., in New York City. R. E. Nelless has been appointed manager.

The Sutton-Raymond Corporation, dealers in welding equipment and supplies, has opened a new plant at 108 West 12th St., Indianapolis.

The foundry plant of the Detroit Stoker Co., now located at Bowling Green, Ohio, will be moved to Monroe, Mich., on Jan. 1, when factory buildings now planned will be completed. The company will erect three units: a foundry, 150x162 ft.; a pattern shop, and a pattern storage building, 60x82 ft.; and a sand and coke storage building 20x140 ft. The foundry will be of steel, brick and glass and will be equipped with the latest type of foundry machinery. It will have an electrically operated crane, monorail system for the distribution of iron, pneumatic molding machines, rammers and mechanical cupola charger.

The American Spring Clutch Co., of Indianapolis, has purchased the Central Gear and Manufacturing Co., 311 East South St. It was announced that the American company will continue the manufacture of gears and automotive parts at the Central plant.

Wilson & Brown, Inc., machine tool dealers, have moved into larger offices at 2 Rector St., New York City.

N. A. Strand & Co., of Chicago, have appointed the E. L. Essley Machinery Co., of Milwaukee, as exclusive distributor in Wisconsin for their machines, flexible shaftings and other machine shop equipment.

The Yale & Towne Manufacturing Co. has purchased the Sager Lock Co., of Chicago, and the Barrows Lock Co., of Lockport, Ill.

The abrasive Co., of Philadelphia, has opened a district office in Detroit, at 149 Larned St. This office is in charge of W. A. MacFarland.

Obituaries

FRED E. BRIGHT, former president of the Hess-Bright Manufacturing Co., of Philadelphia, died on Oct. 6 at Greenwich, Conn. He was in his sixty-ninth year.

Mr. Bright was educated as an engineer at Mount Union College, Ohio, and later entered business in Cleveland. He was one of the organizers of the Cleveland Cap Screw Co. in 1901, and of the Hess-Bright Manufacturing Co. in 1904. He headed the latter company until he retired in 1916. He invented many devices, including various improvements for type-setting machines.

Mr. Bright was a member of the American Society of Mechanical Engineers, the Cleveland Engineering Society, the Royal Society of Arts, in London, and the Ohio Society, in New York.

WILLIAM B. DUKESHIRE, treasurer of the Dukeshire Steel and Forge Co., of Maspeth, Long Island, N. Y., died on Sept. 25.

DAVID DAWBARN, sales engineer with the Allis-Chalmers Manufacturing Co., of Milwaukee, was killed in an automobile accident in Milwaukee on Oct. 1. Mr. Dawbarn came to Milwaukee from Liverpool, England, to study factory methods at the main plant of the company.

W. R. FORTNEY, Chicago representative of the Landis Tool Co., of Waynesboro, Pa., and well known in the machine tool industry, was killed in an automobile accident on Sept. 28, while driving near Cudahy, Wis. His car was struck by an express train.

Trade Catalogs

Drill-Jig Bushings. Ex-Cell-O Tool & Manufacturing Co. 1469 Grand Blvd., Detroit, Mich. A loose leaf catalog has been published with four pages in description of the XLO drill-jig bushings. In addition, there are included several pages of revised data sheets on the sizes, styles and prices of the different designs of available bushings.

Electrical Charging Plugs and Receptacles. Albert & J. M. Anderson Manufacturing Co., 289-305 A St., Boston, Mass. Bulletin No. 39 is a 70-page, 8 x 10½ in. catalog of the plugs and receptacles manufactured by this company. A few photos of actual installations are shown, while the many models in this line of equipment are profusely illustrated with individual cuts and line drawings.

Grinding Spindles, Internal. Ex-Cell-O Tool & Manufacturing Co., 1469 East Grand Blvd., Detroit, Mich. The uses and features of the XLO internal grinding spindles are discussed in a catalog prepared in the loose-leaf style. Detail drawings, photographs and descriptions are given of each of the models, as well as a price list.

Hand Saws. Henry Disston & Sons, Inc., Philadelphia, Pa. "How a Disston Hand Saw is Made" is the title of a booklet published to describe the methods of manufacture and the processing of the Disston Carpenters' saws.

Buildings. The Austin Co., Cleveland, Ohio. The Austin Book of Buildings, eighth edition, catalog No. 20, containing ninety-six 8½x11-in. pages is devoted to illustrations of many types of industrial buildings erected by this company. Section I is devoted to a description of the Austin method of building with many examples of constructions. These examples range from gymnasiums to railroad roundhouses. The method of treatment is to handle each industry in the description separately.

Section II contains descriptions of the Austin standardized types of houses and here also are described the material sales and building equipment services of this company.

Monel Metal. The International Nickel Co., 67 Wall St., New York, N. Y., has published a series of reprints of advertisements placed in the August 1925, issue of *Chemical and Metallurgical Engineering* by manufacturers featuring monel-metal products.

Properties of Steel Filler Rods for Gas and Electric Welding. Published by the Chicago Steel & Wire Co., 103rd St. & Torrence Ave., Chicago, Ill. This 28-page pamphlet will be found the source of much information on the manufacturing problems of filler rods, causes of weld failures and the chemical analysis of the material. The text is well written, concise and original, most of the information being the summarization of long research work in this field.

Oil Cups and Lubricating Devices. Gits Bros. Manufacturing Co., 1940 S. Kilbourne Ave., Chicago, Ill. Catalog No. 21, fifty-five 8½x10½-in. pages. Full-size illustrations are used to show the many types and forms in which the oil cups are made. Each type is given a page description and a table lists the standard sizes of each type obtainable.

Calendar of Local Meetings

National Association of Cost Accountants

New York Chapter. Nov. 10. "The Elements of Standard Costs," by G. Charter Harrison.

Albany Chapter. Nov. 11. Description of manufacturing methods and discussion of general accounting scheme and accounting methods.

Worcester Chapter. Nov. 12. "Mechanical Appliances—Their Uses and Costs."

Philadelphia Chapter. Nov. 13. "Relation of Sales Quotas and Credits to Production and Costs," by J. W. Hallman.

Mohawk Valley Chapter. Nov. 16. "Materials Budget, or Costing the Materials."

Forthcoming Meetings

Motor and Accessory Manufacturers' Association. Fall meeting, Prince Edward Hotel, Montreal, Canada, Oct. 14 to 16. M. L. Heminway, general manager, 250 West 57th St., New York.

National Industrial Advertisers' Association. Annual meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., Oct. 19 to 21. W. A. Wolff, chairman, the Western Electric Co., 195 Broadway, New York.

Management Week. Conducted jointly by five societies—The American Society of Mechanical Engineers, The American Management Association, The National Association of Cost Accountants, The Taylor Society and the Society of Industrial Engineers. Week of Oct. 19 to 24. W. L. Conrad, of the A. S. M. E., is chairman of the joint committee.

American Welding Society. Exposition of welding equipment and accessories, Massachusetts Institute of Technology, Cambridge, Mass., Oct. 21, 22 and 23. R. L. Browne, chairman, 141 Milk St., Boston, Mass.

American Society of Mechanical Engineers. Annual meeting, Engineering Societies Bldg., 29 West 39th St., New York City, Nov. 30, to Dec. 4. Calvin Rice, secretary, Engineering Societies Bldg., New York.

National Exposition of Power and Mechanical Engineering. Fourth annual event, Grand Central Palace, New York City, Nov. 30 to Dec. 5. Charles F. Roth, manager, International Exposition Co., Grand Central Palace, New York City.

American Association for the Advancement of Science. Annual meeting, Kansas City, Mo., Dec. 28, 1925, to Jan. 2, 1926. Burton E. Livingston, secretary, Smithsonian Institute Bldg., Washington, D. C.

The Weekly Price Guide

Rise and Fall of the Market

Present firmness in pig iron is the outcome of a rising trend in coke prices. No. 2 f'dry So. iron, for instance, is $20 in small lots and $19.50 per ton for large tonnages; this is the highest range of quotations reached in the past three months. About the only items on the steel list to show decided firmness in the current market are bars, nuts, bolts, and fabricated structurals. Demand is a trifle slow at present in sheets, rivets, wire products, tin plates, tank plates, shapes, and pipe. Bars remain firm at $1.90@$2 per 100 lb., Pittsburgh. Shapes are $1.90@$2, with some cutting under reported. Plates, though quoted mostly at $1.80@ $1.90, are said to have gone as low as $1.70 per 100 lb. at mill. Non-ferrous metals are higher with the exception of lead which shows no change. Copper and zinc rose ¼c. and tin 1¼c. per lb. during the week at New York. Belting is considerably firmer than a month ago.

(All prices as of Oct. 9)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$23.05
Northern Basic	22.27
Southern Ohio No. 2	22.77
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	27.37
BIRMINGHAM	
No. 2 Foundry	19.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.26
Virginia No. 2	29.17
Basic	21.16
Grey Forge	....
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	25.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.77
Basic	20.77
Bessemer	20.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.00@5.50
Cleveland	4.90@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.25@2.30	3.89	3.00	3.50
No. 12	2.30@2.35	3.94	3.05	3.55
No. 14	2.35@2.40	3.99	3.10	3.60
No. 16	2.45@2.50	4.09	3.20	3.70
Black				
Nos. 17 to 21	2.90@3.00	4.15	3.60	3.80
Nos. 22 to 24	2.95@3.05	4.20	3.65	3.85
Nos. 25 and 26	3.00@3.10	4.25	3.70	3.90
No. 28	3.10@3.20	4.35	3.80	4.00
Galvanized				
Nos. 10 and 11	3.20	4.35	4.00	4.00
Nos. 12 to 14	3.30	4.45	4.10	4.10
No. 16	3.45	4.60	4.25	....
Nos. 17 to 21	3.60	4.75	4.40	4.40
Nos. 22 to 24	3.75	4.90	4.55	4.55
No. 26	3.90	5.05	4.70	4.70
No. 28	4.20	5.35	4.95	5.00

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
3½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameters Inches External	Diameters Inches Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.15	50%	⅞	$0.18	35%
⅜	.16	45%	1	.19	31%
½	.17	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.30 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.00	....	4.00@4.65
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.05	....	....
Hoop steel	4.49	3.85	4.15
Cold rolled strip steel	6.35	8.25	6.80
Floor plates	5.55	5.60	5.50
Cold drawn shafting or screw	4.15	3.80	3.60
Cold drawn flats, squares	4.65	4.30	4.10
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.10
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.40	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	60%

Electric welding wire, New York, 5/32, 8.25c.; 1/8, 7.85c.; 5/32 to 1/4, 7.35c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.12½
Tin, 5-ton lots, New York			62.75
Lead (up to carlots) E. St. Louis	9.25	New York	10.25
Zinc (up to carlots) E. St. Louis	8.00	New York	9.00

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	18.00	19.75	....
Copper sheets, base	22.75	22.75	22.75
Copper wire, base	20.25	17.00	16.75@17.00
Copper bars, base	21.87½	21.50	21.87½
Copper tubing, base	24.75	25.50	24.75
Brass sheets, base	19.12½	19.00	19.12
Brass tubing, base	23.75	23.75	23.75½
Brass rods, base	16.87½	16.87½	16.87
Brass wire, base	19.62½	22.50	19.62½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1–15 ton lots	28.00	28.00	28.03
Zinc sheets (casks)	11.25	12.00	11.52
Solder (½ and ½), (case lots)	39.50	39.00	38@42
Babbitt metal (83% tin)	60.00	70.75	58@63
Babbitt metal (35% tin)	28.00	22.50	30@35
Nickel (ingots) f.o.b. refinery	31.00	.....	.....
Nickel (electrolytic) f.o.b. refinery	38.00	.....	.....
Nickel (shot) f.o.b. refinery	32.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00
Cold rolled sheets (base)			50.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.25@12.50	11.50	11.75@12.25
Copper, heavy, and wire	11.75@12.00	11.25	11.00@11.50
Copper, light, and bottoms	10.00@10.25	9.50	10.00@10.75
Heavy lead	7.75@ 8.25	7.50	7.75@ 8.25
Tea lead	6.50@ 7.00	4.50	6.25@ 6.75
Brass, heavy, yellow	7.25@ 7.50	7.00	7.50@ 8.00
Brass, heavy, red	12.00@12.25	....	8.50@ 9.00
Brass, light	6.25@ 6.50	6.00	7.00@ 7.50
No. 1 yellow rod turnings	8.00@ 8.50	9.25	7.50@ 8.00
Zinc	4.75@ 5.25	4.25	4.25@ 4.75

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$11.25	$11.45	$11.50
"A" Grade:				
IC,	14x20	8.85	9.40	9.50
	Coke Plates—Primes.			
100-lb.,	14x20	6.50	6.10	7.00
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.25	6.95	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.20
Cotton waste, colored, per lb.	.10@ .15½	.18	.17
Wiping cloths, washed white, per lb	.17	36.00 per M	.15½
Sal soda, per 100 lb. keg	2.25	2.25	2.75
Roll sulphur, per 100 lb. keg	3.75	3.75	4.50
Linseed oil, per gal., 5 bbl. lots	1.04½	1.15	1.03
Lard cutting oil, 25% lard, per gal.	.55	.50	.72
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.35	.35	.26
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40%	40%	30–10%
Heavy grade	30–10%	35%	30–5%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.0415	.0415	.0405
Brass rods	per lb	.1687½	.1687½	.1462½
Solder (½ and ½)	per lb.	.395	.395	.37@.38
Cotton waste	per lb.	.15@.22	.15@.22	14@21
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.55	3.55	3.38
Lard cutting oil	per gal.	.55	.55	.55
Machine oil	per gal.	.35	.35	.29
Belting, leather, medium	off list	40%	40%	40–2½%
Machine bolts up to 1x30 in.	off list	40%	40%	50%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.46	$5.84	$5.00
Emery paper	10.71	11.00	11.90
Emery cloth	29.48	31.12	32.75
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.41	1.40
Cloth	3.55	2.67	3.55
Fire clay, per 100 lb. bag	.....	.60	.75
Coke, prompt furnace, Connellsville	per net ton		3.50@4.00
Coke, prompt foundry, Connellsville	per net ton		4.75@5.25
White lead, dry or in oil	100 lb. kegs		New York, 15.75
Red lead, dry	100 lb. kegs		New York, 15.75
Red lead, in oil	100 lb. kegs		New York, 17.25

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1¼ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%. Machine bolts, up to 1x30-in., with cold punched and hot-pressed hex. nuts, also button head bolts with hex. nuts are $3.60@3.75 per 100 lb. at Cleveland.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x½-in., $1.00 per 100. List plus 35% at New York warehouses; with hex. heads, $4.65 per 100 lb. net at Chicago.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ½x½-in., 2c. each. Discount 70% for $\frac{5}{16}$-in. and smaller and 65% for ⅜-in. and larger.
Case hardened ½x½-in., 6c. each, less 50%.

Rivets, button heads, ¾-in., ⅞-in., 1-in. diam.x2$\frac{1}{16}$-in. to 4½-in. $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{7}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1¼ to 2-in. long, all diameters, 25c.; ¾-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅝-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Ark., Fort Smith — The Ward Furniture Co.—equipment for new 2 story 80 x 150 ft. plant.

Calif., Oakland—The Miller Auto Bed Co., 1112 East 12th St.—punches, lathe, motors, spray painting, enamel baking, small chain machines, carton making and folding machines, etc.

Mich., Detroit—General Necessities Corporation, 2011 Park Ave.—machinery and equipment for the manufacture of iceless refrigerators, ice cream cabinets, etc. for plant at Bagley Ave.

Mich., Springwells—Detroit Motorbus Co., 14401 Dexter Blvd.—equipment for maintenance of motorbuses.

N. Y., Buffalo — General Electric Co., Genessee and Washington Sts.—equipment for service shop and war house.

N. Y., Buffalo—J. Ullman, 84 Oneida St.—equipment for saw manufacturing plant.

N. C., Raleigh—G. T. Sullivan, 630 Hillsboro St.—nailing machine to nail 58 No. 4 nails at one time in wood ½ to ¾ in. thick.

O., Columbus—Boyestown Burial Casket Co., 1675 South High St.—welding equipment for metal casket department in factory.

O., Columbus — Scioto Motors Co., 841 North High St.—lathe, grinding machine and drill press.

O., Columbus—J. H. Zinn Lumber Co., 19 East Hudson St., M. A. Grannin, Gen. Mgr., (millworking)—sander, ordinary size.

O., Youngstown — Youngstown Sheet & Tube Co., West Federal St.—two 10 ton, two 30 ton, one 20 ton and one 40 ton overhead electric cranes.

Pa., Beaver Falls—C. Allard—lathe, drill press, cylinder reboring machine and air compressor.

Pa., Wilkes-Barre — Hazzard Mfg. Co., Hazle St.—machinery and equipment for wire rope factory.

Ont., Aylmer — L. Harvey — complete equipment for garage and repair shop. Estimated cost $40,000.

Ont., Bracebridge—J. T. Shier—prices on all equipment for planing mill and woodworking plant to replace fire loss. Estimated cost $30,000.

Ont., Port Elgin—C. Maas—equipment for saw and shingle mill to replace fire loss. Estimated cost $20,000.

Que., Montreal—Canadian Prest-Air Ltd., 263 St. James St., A. Pope, Purch. Agt.—squaring shears, heading machine and other equipment for sheet metal shop.

Que., Montreal — J. Desrosiers, 269 Christopher Columbus St. — sander and planer.

Que., Montreal — D. Lewinchuk, 59 Napoleon St. E.—wood lathe and combination woodworker.

Que., Montreal—G. Rochon, 1148 Bellechane St. E.—matcher and band saw.

Opportunities for Future Business

Calif., Oakland — The Miller Auto Bed Co., 1112 East 12th St., will build a 1½ story, 60 x 125 ft. factory for the manufacture of disappearing beds for automobiles. Estimated cost $20,000. L. F. Hyde, 372 Hanover Ave., Archt.

Conn., Bridgeport—Mack Motor Co., 561 Washington St., New York N. Y., is having plans prepared for the construction of a garage, sales and service station on Ash Creek. Estimated cost $150,000. Private plans.

Mass., Boston—A. J. Daley, 31 Milk St., plans the construction of a 1 story repair and service garage. Estimated cost $40,000. Monks & Johnson, 99 Chauncy St., Archts.

Mass., Holyoke—Charlton Inc., Elm and Suffork Sts., awarded contract for the construction of a 1 story, 110 x 110 ft. repair and service garage. Estimated cost $50,000.

Mass., Lowell—J. L. Kaplan, 111 Chelmsford St., awarded contract for the construction of a 1 and 2 story, 55 x 145 ft. repair and service garage. Estimated cost $50,000.

Mass., New Bedford — Neild Mill Corporation, Nash Road awarded contract for the construction of a 1 story, 112 x 190 ft. addition to plant. Estimated cost $60,000.

Mass., Pittsfield — City, F. T. Francis, Mayor, will soon award contract for the construction of a 1 story repair and service garage. Harding & Seaver, 7 North St., Archts.

Dear Reader:

If you don't get the order when you follow up the sales leads on this page it may be because of competition by others using the same leads. Concerning one item, a manufacturer wrote us as follows:

"....We have certainly been flooded with inquiries and salesmen calling."

The reason for this is the reliability of the American Machinist. Our reporters all over the country are instructed to verify every report before sending it in.

Yours for service,

BUSINESS NEWS DEPARTMENT,
McGRAW-HILL CO., INC.,
10th Ave. at 36th St., New York.

Mass., Quincy (Boston P. O.)—Norfolk Woodworking Co., Braintree, will build a group of buildings including a 140 x 260 ft. mill, 265 x 285 ft. cabinet shop and storage building, 35 x 70 ft. office and storage building, etc., on Hancock St. here. Estimated cost $70,000. S. J. Joslin, 330 Newbury St., Boston, Archt.

Mass., Roxbury (Boston P. O.)—H. B. Church Truck Service Co., 26 Reading St., awarded contract for the construction of a 1 story, 72 x 112 ft. repair and service, garage at 32-36 Reading St. Estimated cost $45,000. Noted Sept. 24.

Mass., South Boston (Boston P. O.) — Gillette Safety Razor Co., 41 West First St., is having plans prepared for the construction of the first unit, 8 story, 75 x 152 ft. handle building. Estimated cost $400,000. Total cost $1,000,000. Monks & Johnson, 99 Chauncy St., Boston, Archts. and Engrs.

Mich., Detroit — Edward G. Budd Mfg. Co., 25th and Hunting Pk., Philadelphia, Pa., has purchased a 24 acre site and plans the construction of a 4 story, 100 x 725 ft. plant for upholstering and furnishing all steel automobile bodies here. Estimated cost $1,500,000.

Mich., Detroit—Ford Motor Co., Highland Park, awarded contract for the construction of a 3 story, 67 x 851 ft. addition to Lincoln plant on Livernois Ave. Noted Sept. 24.

Mich., Springwells — Detroit Motorbus Co., 14401 Dexter Blvd., Detroit, awarded contract for the construction of a 1 story, 135 x 300 ft. terminal building here to Austin Co., 2201 First National Bank Bldg.

Minn., Minneapolis — Marrin Foundry Co., 416 North East Lincoln St., moulding machines for proposed 1 story, 40 x 86 ft. foundry.

Minn., St. Paul—The Seeger Refrigerator Co., Arcade St. and Wells Ave., awarded contract for the construction of a 1 story, 88 x 200 ft. addition to plant. Estimated cost $90,000 including equipment.

N. J., Montclair—Town Comrs., H. Trippett, Clk., has authorized the construction of a 1 story, 65 x 146 ft. central storehouse and repair shop at 219 North Fullerton Ave. for the Dept. of Public Works. Estimated cost $40,000.

N. Y., Buffalo — General Electric Co., Genessee and Washington Sts., plans the construction of a warehouse and service shop on French St. Estimated cost to exceed $100,000.

N. Y., Coney Island—Bd. of Transportation, J. H. Delaney, Chn., 49 Lafayette St., New York, will receive bids until Oct. 22 for the construction of the enclosures of the main repair shop at Ave. X and Shell Road here.

O., Defiance—The Defiance Automatic Screw Co., K. F. Serrick, Gen. Mgr., has purchased a tract along the Wabash railroad and plans the construction of a new factory to triple capacity of plant.

O., Norwood — American Laundry Machine Co., Ross St. and Section Ave., awarded contract for the construction of a 2 story factory for the manufacture of laundry machinery. Estimated cost $400,000.

Pa., Reading—Reading Co., Reading Terminal, Philadelphia, awarded contract for the construction of car shops here. Estimated cost $1,500,000.

Pa., Wilkes-Barre—Hazzard Mfg. Co., J. T. Coyngham, Pres., awarded contract for the construction of a 3 story, 110 x 180 ft. wire rope factory. Estimated cost $180,000.

Tenn., Chattanooga — Chattanooga Stamping & Enameling Co. is having plans prepared for the construction of a 1 and 2 story, 50 x 100 and 30 x 60 ft. metal working plant. Estimated cost $50,000. E. P. Poste, c/o owner, Ch. Engr.

Tex., Houston—The Crane Co., 836 South Michigan Ave., Chicago, Ill., will soon award contract for the construction of a 4 story, 100 x 189 ft. main building and 1 story, 61 x 80 ft. pipe warehouse at McKinney Ave. and Hutchins St. here. Estimated cost $90,000. A. C. Finn, Bankers' Mortgage Bldg., Archt.

Wis., Kenosha—Wisconsin Gas & Electric Co., Public Service Bldg., is receiving bids for the construction of a 2 story, 82 x 125 ft. garage and storage building. Estimated cost $150,000.